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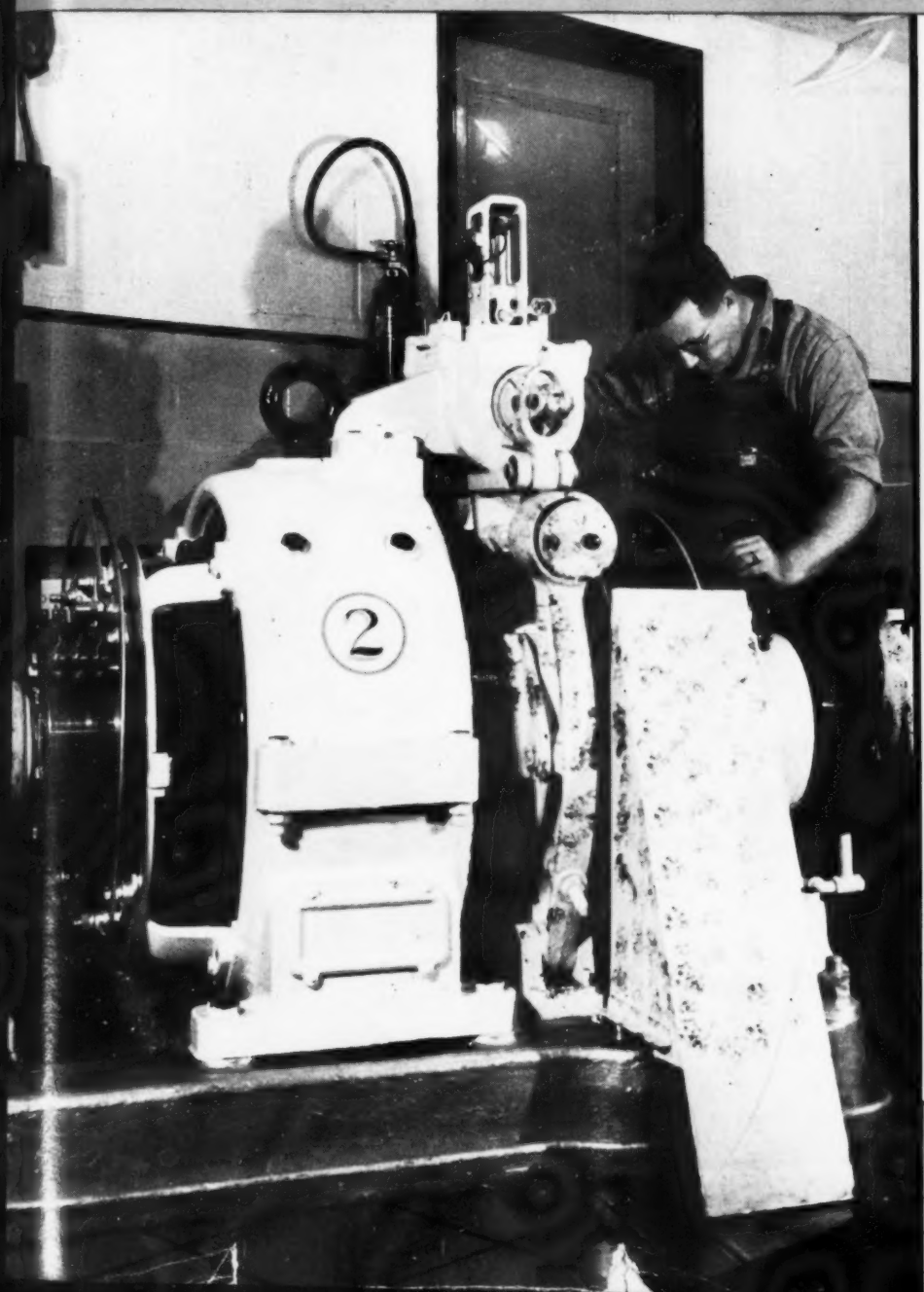
POWER

GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES



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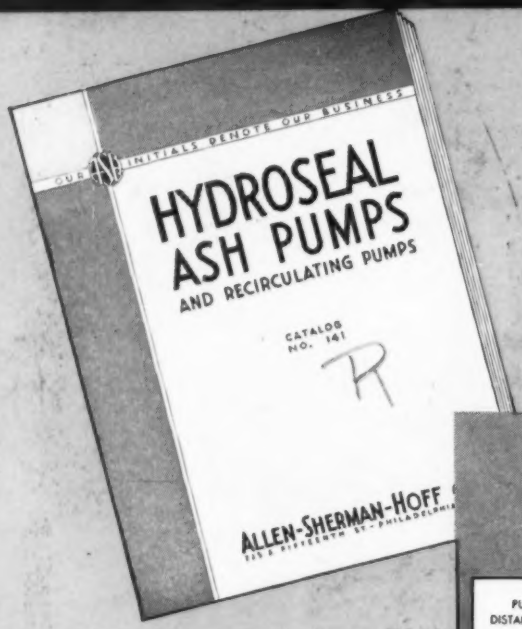
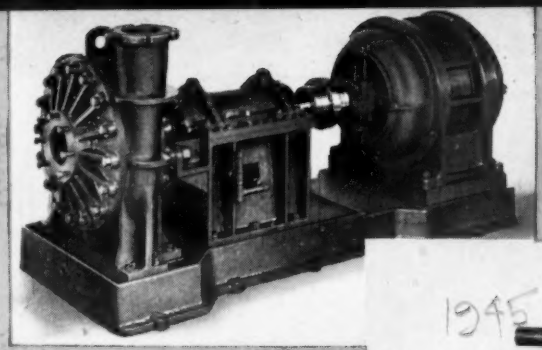
More power for Florida results from installation of a 25,000-kw 850-psi 900-F base-load unit at Bayboro plant, St Petersburg. Four-point bleed heating and electrically driven auxiliaries feature layout. For description of design and how it was affected by wartime procurement difficulties, see p 64

Boiler fans must be designed for maximum air flow but operate much of the time at part loads, thus requiring some form of air-flow control. There are three basic methods: outlet dampers, inlet vanes and variable-speed drive. For a practical discussion of the advantages and disadvantages of each method, turn to the article beginning on p 78

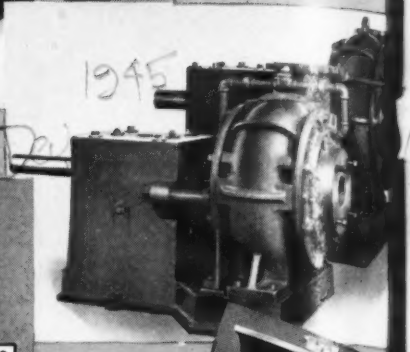
◀ Safe, economical operation requires continuous study of methods, equipment. *See p 69*

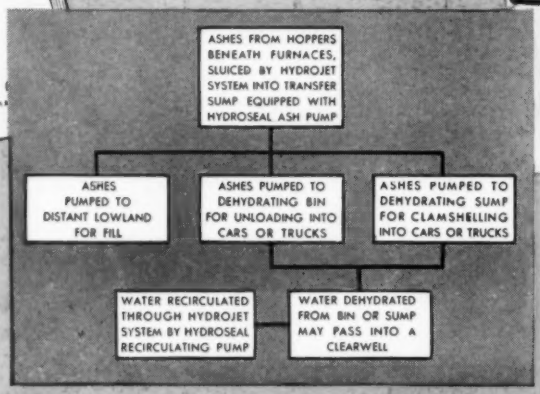




Hydroseal Recirculating Pump

Hydroseal Ash Pumps

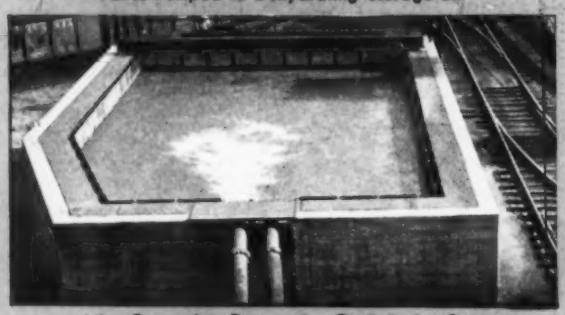



ASHES FROM HOPPERS BENEATH FURNACES, SLUICED BY HYDROJET SYSTEM INTO TRANSFER SUMP EQUIPPED WITH HYDROSEAL ASH PUMP
ASHES PUMPED TO DISTANT LOWLAND FOR FILL
ASHES PUMPED TO DEHYDRATING BIN FOR UNLOADING INTO CARS OR TRUCKS
ASHES PUMPED TO DEHYDRATING SUMP FOR CLAMSHELLING INTO CARS OR TRUCKS
WATER RECIRCULATED THROUGH HYDROJET SYSTEM BY HYDROSEAL RECIRCULATING PUMP
WATER DEHYDRATED FROM BIN OR SUMP MAY PASS INTO A CLEARWELL

Ashcolite Pipe used with Hydraulic Ash Handling

Pumping Ashes to Distant Fill

Ashes Pumped to Dehydrating Storage Bin



Ashes Pumped to Dewatering Grab Bucket Sump

Guidebook For Planning Your Post War Ash And Dust Disposal

"PUMP YOUR ASHES" has been our cry, ever since the earliest days of the Hydrojet System. Hydroseal Pumps are now used under practically every conceivable condition, handling everything from stoker ash to precipitator dust. In practically every case, we have found that hydraulic ash handling is the most inexpensive method where the engineer considers maintenance, labor and power, in addition to first cost. . . . Hydroseal Ash and Recirculating Pumps are specially designed for economical handling of abrasive solutions. Before you get too far with your post war plans, get our Catalog No. 141, or talk to our nearest engineer.

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POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), October, 1945, Vol. [illegible] No. 10. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

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THE "ROAD" to EFFICIENT BELT CONVEYING

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BELT CONVEYOR IDLERS

● Top performance in belt conveyors depends, in a great measure, upon the structure on which the load moves. So, begin at the beginning and make sure you select the right type. Link-Belt Roller Bearing Belt Conveyor Idlers are the outgrowth of almost 50 years of constant development. Engineering development that has kept pace with growing service needs, has achieved outstanding design in today's Link-Belt Idlers.

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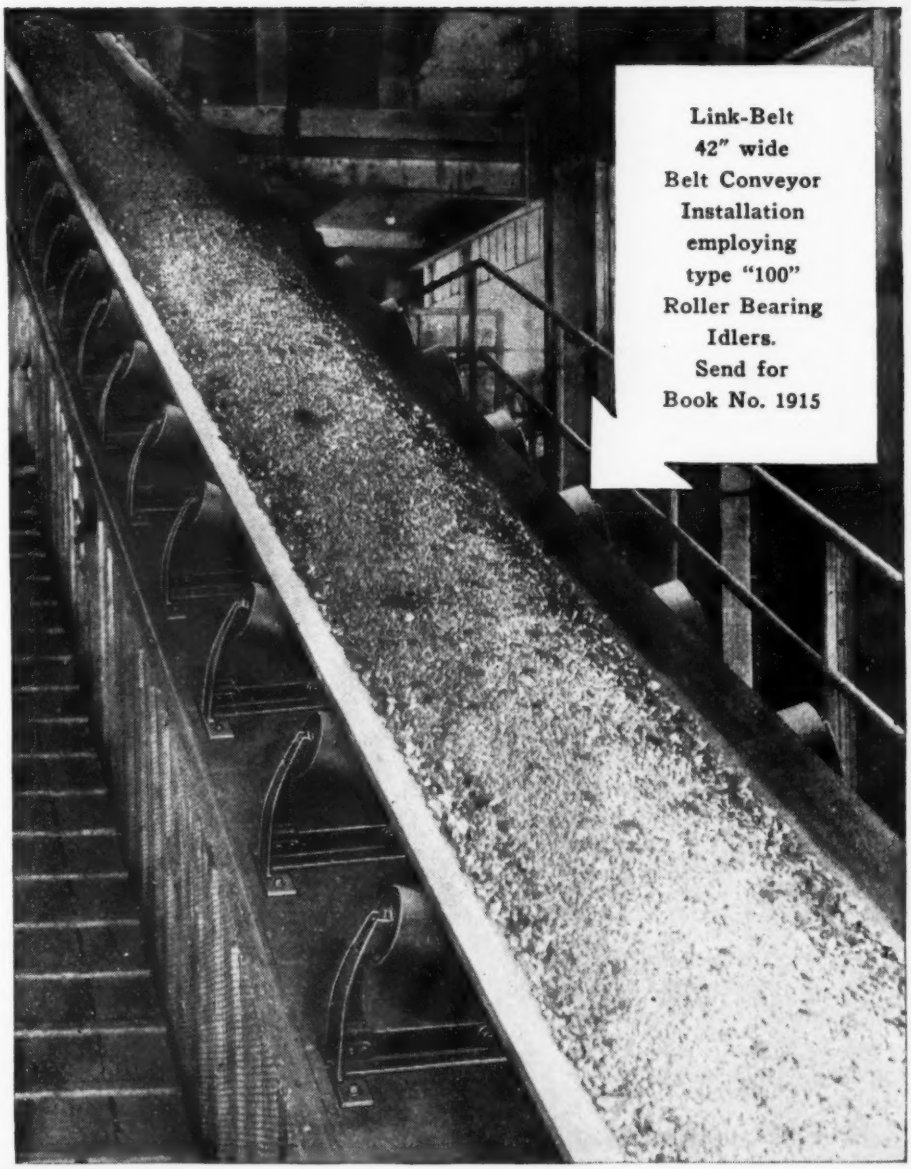

Link-Belt 42" wide Belt Conveyor Installation employing type "100" Roller Bearing Idlers. Send for Book No. 1915

Assure longer life to conveyor belts by using Link-Belt Self-Aligning Idlers. They automatically maintain the conveyor belt in a central carrying position without injury to its edges. Made in two types for regular or reversing travel.

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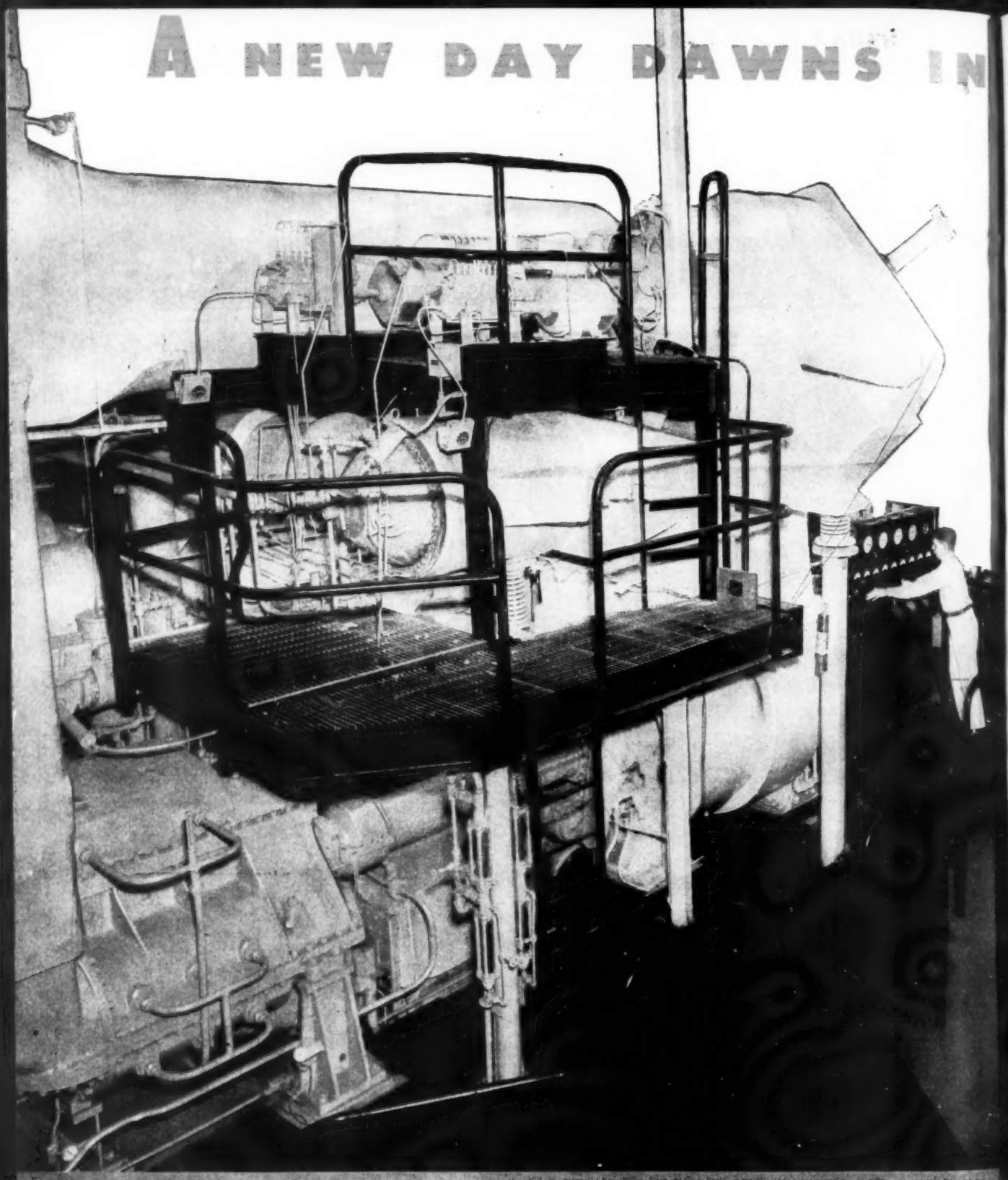
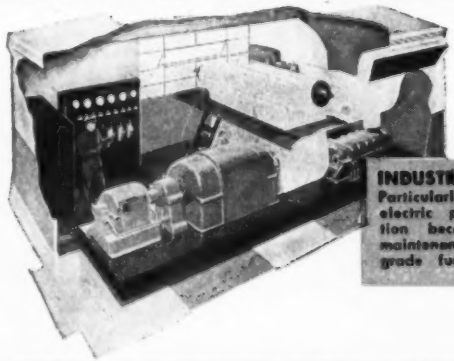
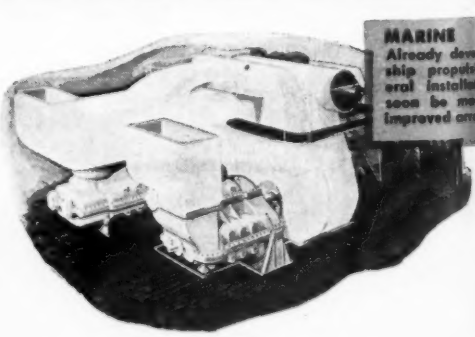


Practical Applications of the
ELLIOTT
GAS TURBINE



INDUSTRIAL
Particularly adaptable to electric power generation because of low maintenance and low grade fuel required.



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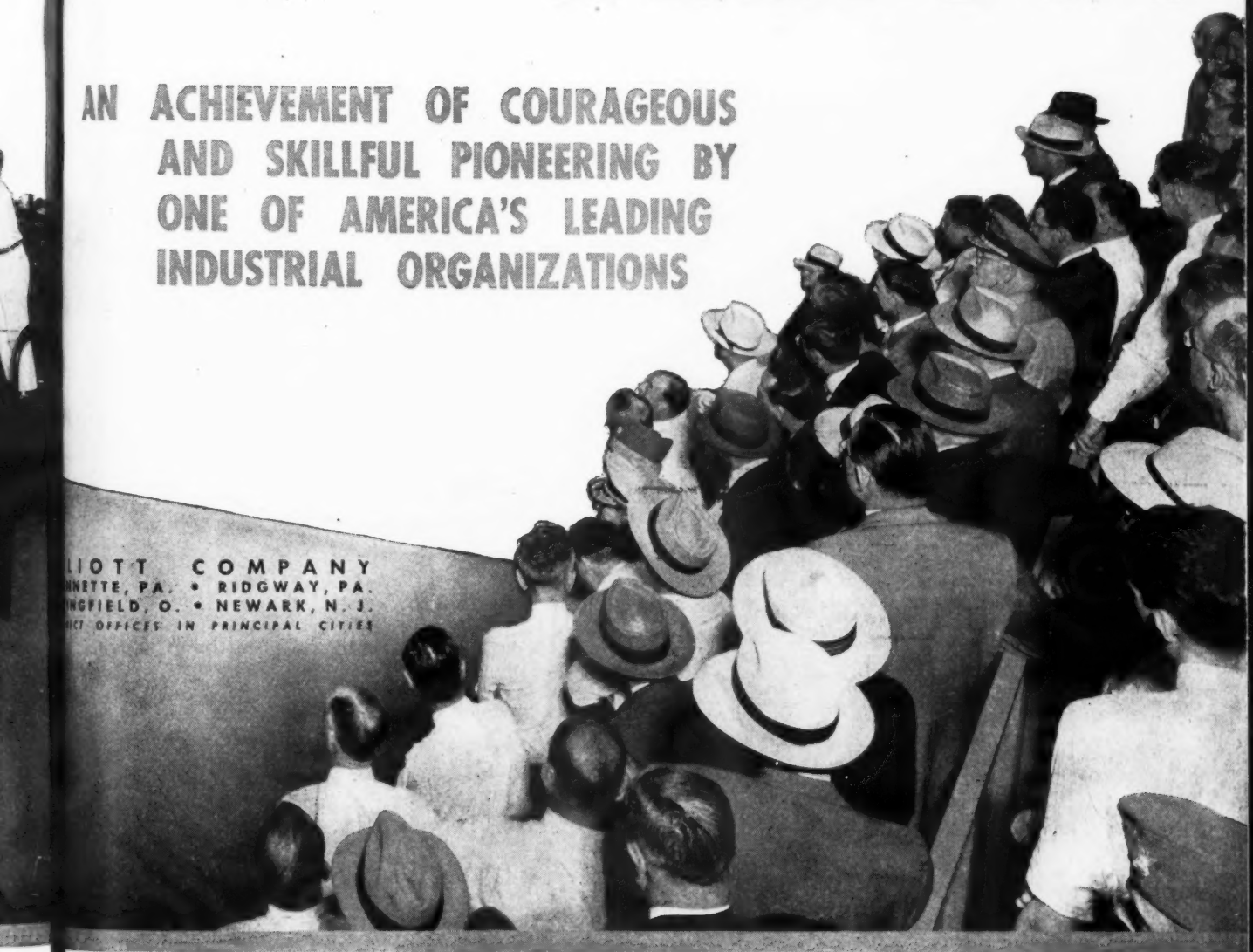
THE POWER FIELD *with the*

Gas Turbine

by ELLIOTT

AN ACHIEVEMENT OF COURAGEOUS AND SKILLFUL PIONEERING BY ONE OF AMERICA'S LEADING INDUSTRIAL ORGANIZATIONS



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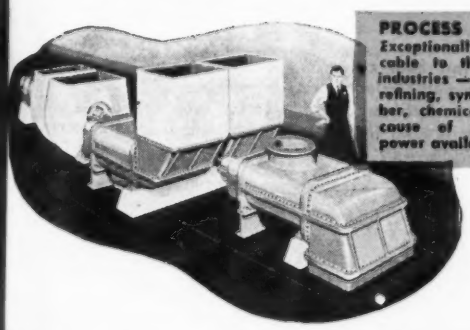

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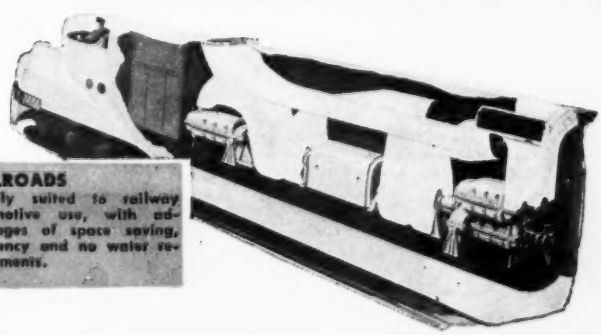
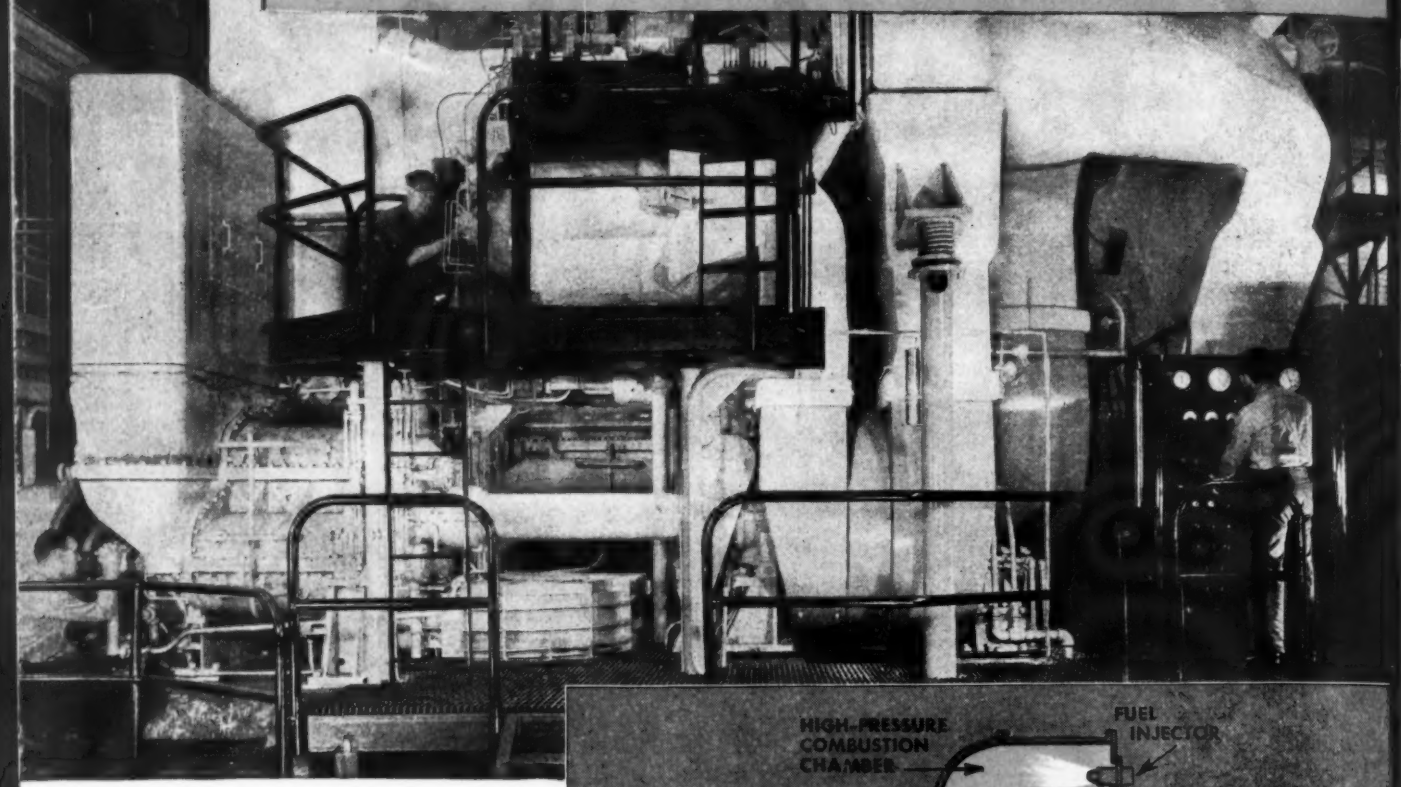
Exceptionally applicable to the process industries — petroleum refining, synthetic rubber, chemicals — because of by-product power available.



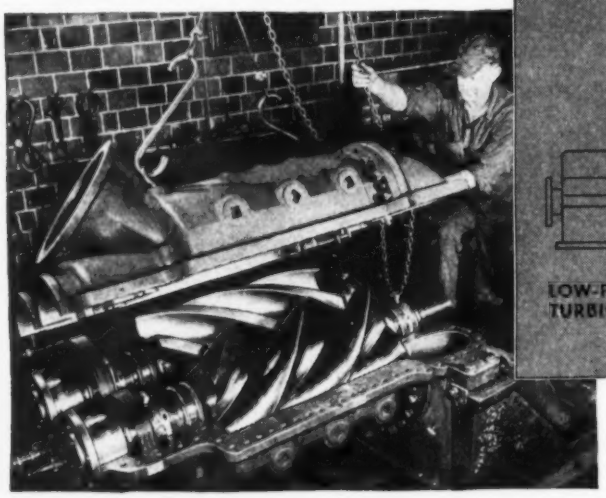
RAILROADS
Ideally suited to railway locomotive use, with advantages of space saving, efficiency and no water requirements.

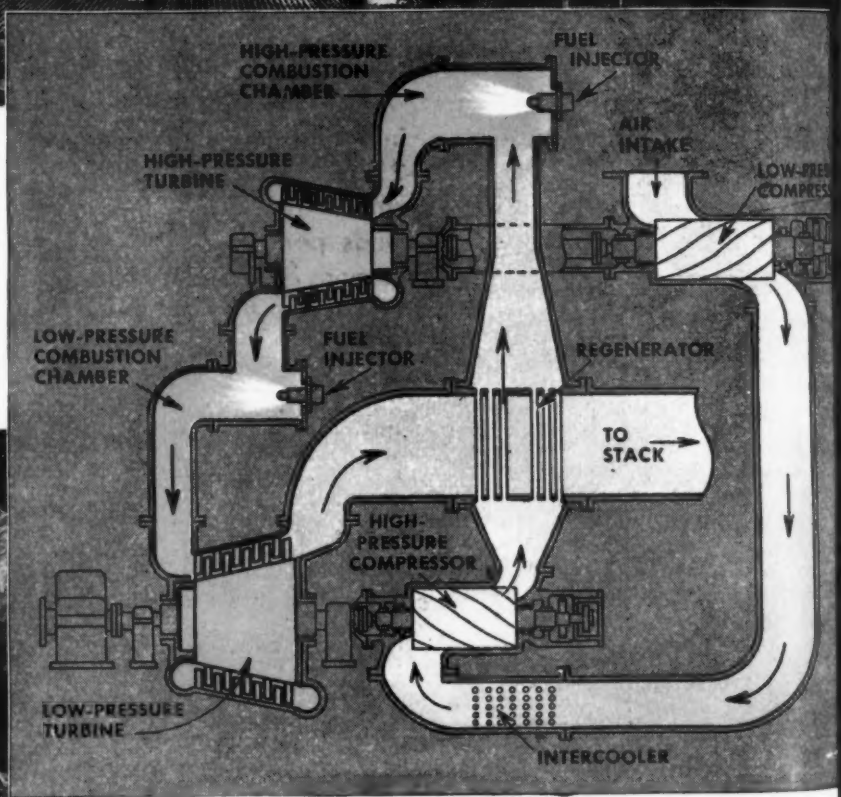
Not a dream of the futur



Side view of the first marine propulsion gas turbine and first complete gas turbine power plant to operate in this country.

One of the compressors which were specially developed for the Elliott Gas Turbine. This is a 12,500-cfm unit, positive in operation, delivering a steady flow of compressed air independent of discharge pressure.





Schematic drawing showing heat cycle and operating principle of the Elliott Gas Turbine. The arrangement includes two compressors of special design, two combustion chambers, two turbines, a regenerator and intercooler. The only valves in the entire cycle are on the fuel spray system and intercooler.

ELLIOTT COMPANY

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ut a reality of today—

ELLIOTT GAS TURBINE

IT'S HERE, NOW—this new prime mover that engineers everywhere have been looking for, that a number of large builders of heavy equipment have sought to develop. The new power unit that turns fuel into power directly without steam equipment or reciprocating engine design. Elliott Company, after years of research and experimentation, marked by characteristically ingenious engineering skill, has built and operated the first successful gas turbine for ship propulsion ever developed. The Elliott gas turbine plant is in production.

Further developments and improvements are naturally to be expected. But the *tough job is done*—there remains now the task of applying this new Elliott prime mover to the various needs of industry and transportation. A few of these applications have been worked out in their probable forms, as illustrated on a preceding page.

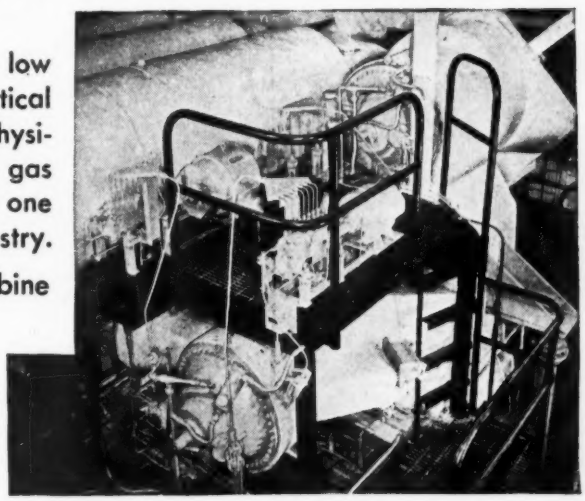
Some of the characteristics and vital data of the Elliott Gas Turbine as established in the present unit, will be of interest . . . horsepower—2500 . . . overall efficiency —29 percent (32 or 34 percent anticipated in later models) . . . weight—30 pounds per horsepower (expected to be 20 pounds in later models) . . . cubic area—3½ feet per horsepower (probably will be 1 cubic foot or less in later models) . . . fuel—medium grade fuel oil. Lower grades and powdered coal a probability.

The Elliott Gas Turbine is not a dream of future low cost and limitless power . . . It is a thoroughly practical development, utilizing natural thermodynamic and physical laws with which every engineer is familiar. The gas turbine is here, now—Elliott Company's latest and one of its many important contributions to the power industry.

For further information ask for the Gas Turbine issue of POWERFAX.

The entire plant is handled by one man at a central control panel. A flick of the operator's hand steps up or reduces speed and power.

Close-up of the two combustion chambers and fuel injection pumps. Combustion chambers, with very high heat release rate, are remarkably small.



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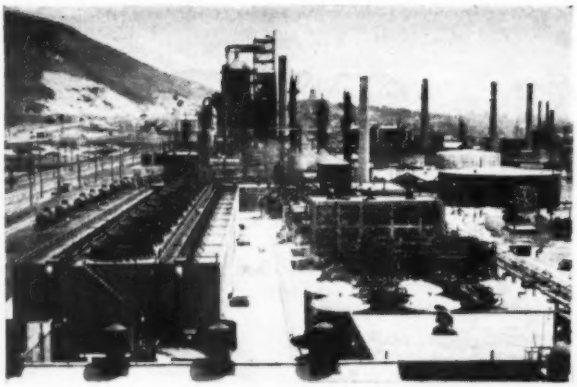
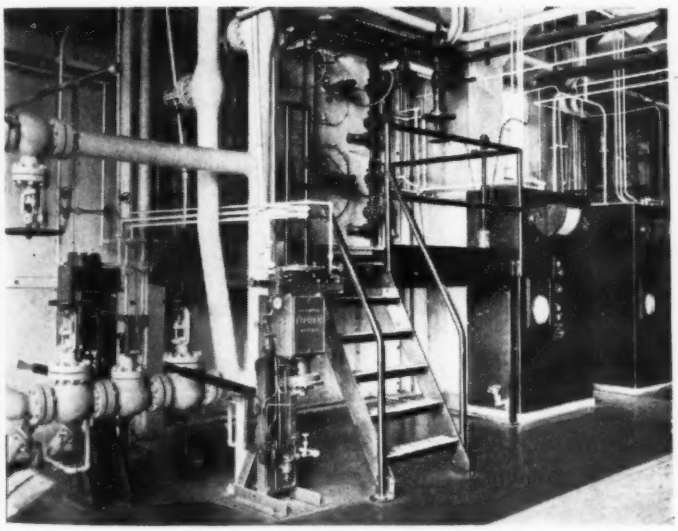


"K-RATION" STATION

Semi-outdoor installation of four B&W Integral-Furnace Boilers for Plant 2 at Utah Oil Refining Company, Salt Lake City. Fired with four B&W Steam-Mechanical Combination Oil and Refinery Gas Burners, each boiler generates 65,000 lb. steam per hour at 325 psi and 525 F. Postwar, the boilers will operate at 615 psi and 700 F. Only the firing aisle and boiler auxiliaries are indoors, as shown on the opposite page. Engineering and design by Sargent & Lundy, Chicago.

FOR FIGHTING PLANES SERVED BY B&W INTEGRAL-FURNACE BOILERS

Not so long ago, the possibility of enemy shells falling on American soil . . . of west-coast refineries being seriously menaced . . . were vital military considerations. So vital, in fact, that steps were taken to provide inland emergency sources of high-octane gasoline. Construction was therefore rushed on additional facilities for this purpose at the Utah Oil Refining Company plant in Salt Lake City.



In this "K-Ration" station—a plant built expressly to insure ample aviation fuel reserves—steam generators of highest dependability were especially imperative.

Four B&W Integral-Furnace Boilers were selected for this new Utah unit. Semi-outdoor installation of the boilers not only speeded completion of the power plant but saved 50 per cent in construction costs. Each boiler produces 65,000 lb. steam per hour at 325 psi and 525 F. total temperature at superheater outlet.

In other refineries, too, as well as in steel mills, chemical plants, ordnance plants, aircraft factories . . . wherever American industries were busy producing materials for war, B&W Integral-Furnace Boilers supplied steam with utmost dependability and efficiency. Thoroughly tried and proved in pre-war services, these boilers have further demonstrated their high availability for service and consistent reliability in tough war-time assignments.

From this additional proving under unprecedented service conditions will come still better B&W Integral-Furnace Boilers for peacetime industry.

For additional information on B&W Integral-Furnace Boilers, send for Bulletin G-17-A.

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

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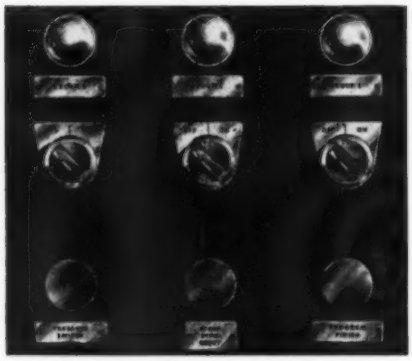
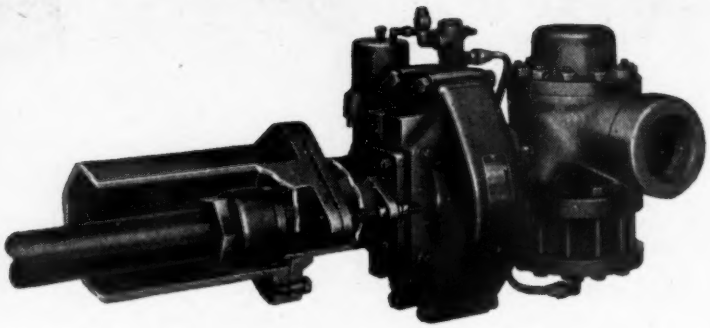
LOWER OPERATING COSTS

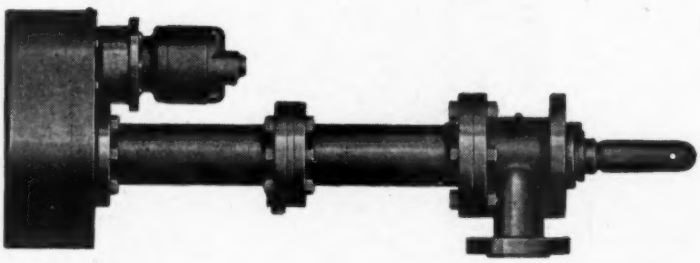
BETTER BOILER CLEANING



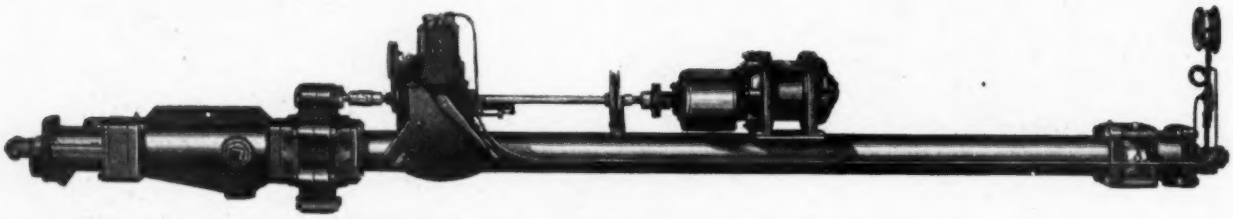
Diamond Program panel controls both fixed and retracting blowers (on boiler, superheater, economizer and air heater). Any desired number of groups can be had when system is designed, but panel shows three groups. Entire soot blowing system is operated automatically in proper sequence and at correct speed by simply pushing "start" button. Any group can be operated independently by simply throwing a switch on control panel.



Diamond "Air Puff" Soot Blower having element permanently installed inside the setting. Compressed air for cleaning is discharged from nozzles in a series of short puffs with substantial pauses between which permits use of a much smaller compressor. Air operation automatically rotates element to new position during each puff. Designed with large valve and large air passages to minimize pressure drop.



Diamond Model IF Retracting Soot Blower (at right) uses compressed air as the cleaning medium and is electrically operated.



Diamond "Telescopic" Soot Blower uses compressed air (or steam) as the cleaning medium and is electrically operated as shown; air operation also available.

RESULT FROM

DIAMOND

AUTOMATIC SEQUENTIAL

SOOT BLOWING with AIR

Soot and slag removal with compressed air instead of steam has a number of important advantages that make for lower operating costs as well as better boiler cleaning. Air eliminates the expense of boiler feed-water makeup, and saves energy from the coal pile. Air provides a dryer medium which is particularly desirable for surfaces operating near the dew point. Air is a more effective medium for slag removal because of its greater density and lower temperature. Air requires less blower maintenance on the basis of experience on installations in service since 1940. Air requires no piping insulation. Air permits better control of fly ash flow and grain loading of gas to dust collectors or to atmosphere. Air, when introduced intermittently instead of continuously, eliminates upset operating conditions during soot blowing period.

Other important advantages that are common to all Diamond Automatic Sequential Soot Blower Systems (steam as well as air) are a saving in labor and the elimination of the "human element" which assures that all blowers are operated in proper sequence and at correct blowing speed every time they are operated. Blowers can be either electrically or air operated and controlled —or a combination of both. System can be remotely operated from boiler control board or most convenient location.

Write for further information regarding Diamond Automatic Sequential Air Soot Blowing Systems that have been giving very satisfactory service on boilers as large as 900,000 lb/hr since 1940.

SPECIALTY CORP. Detroit 31, Mich.

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HOW BAILEY CONTROLS INCREASE SAFETY

SAFE BOILER OPERATION

EXPLOSION HAZARDS REDUCED

1. Automatic Readjustment of fuel-air ratio insures proper mixture for safe efficient combustion.

2. Limit stops and accurate draft control protects against loss of ignition at low ratings.

3. Interlocks may be provided to trip out equipment upon failure of related units.

4. Purge interlocks insure safety in lighting-off.

OPERATORS FREE TO ACT

In emergencies control automatically carries on leaving the operating personnel free to concentrate on the cause of the emergency.

SAFE STEAM TEMPERATURE

Prime movers, superheaters, valves and piping are protected against excessive steam temperatures by superheat control.

NORMAL WATER LEVEL

Damage to turbines from water carry-over and to boiler tubes from low water is avoided by effective feed water control.

BOILER FEED PUMPS

Automatic by-pass control protects feed pumps at low rates of flow.

IN YOUR PLANT

There may be applications where Bailey Controls will improve safety, lower fuel and maintenance costs, and enable you to render better power service.

Call on your local Bailey engineer to make recommendations or write for Bulletin 15-C which describes Bailey Controls for Steam Plants. Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio. In Canada—Bailey Meter Company Limited, Montreal.

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Controls for Steam Plants

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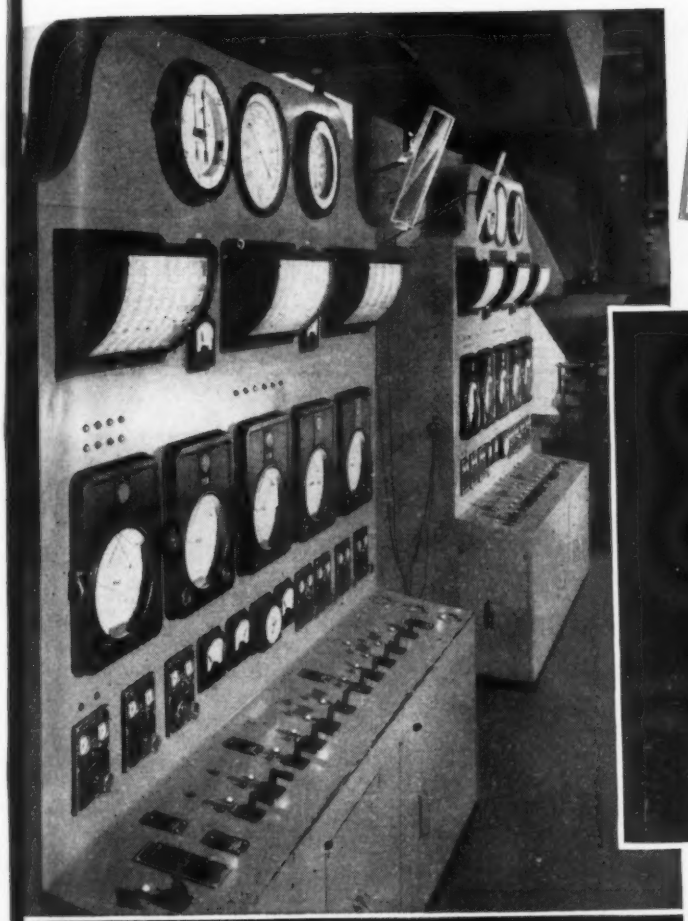
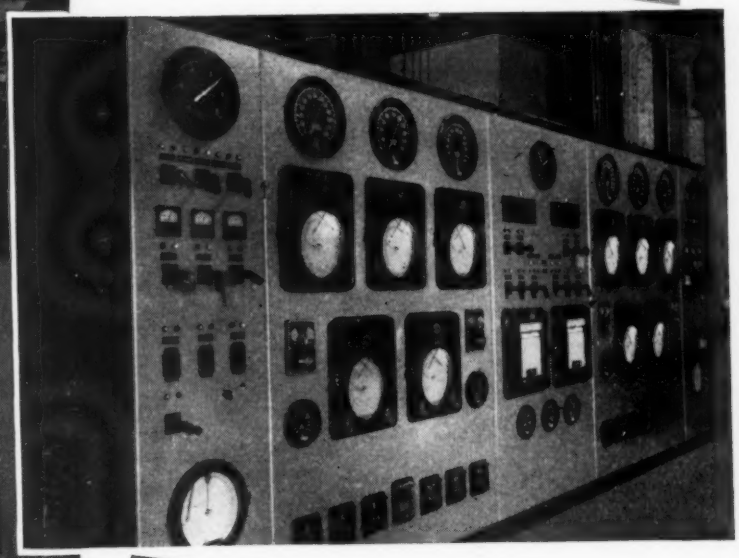
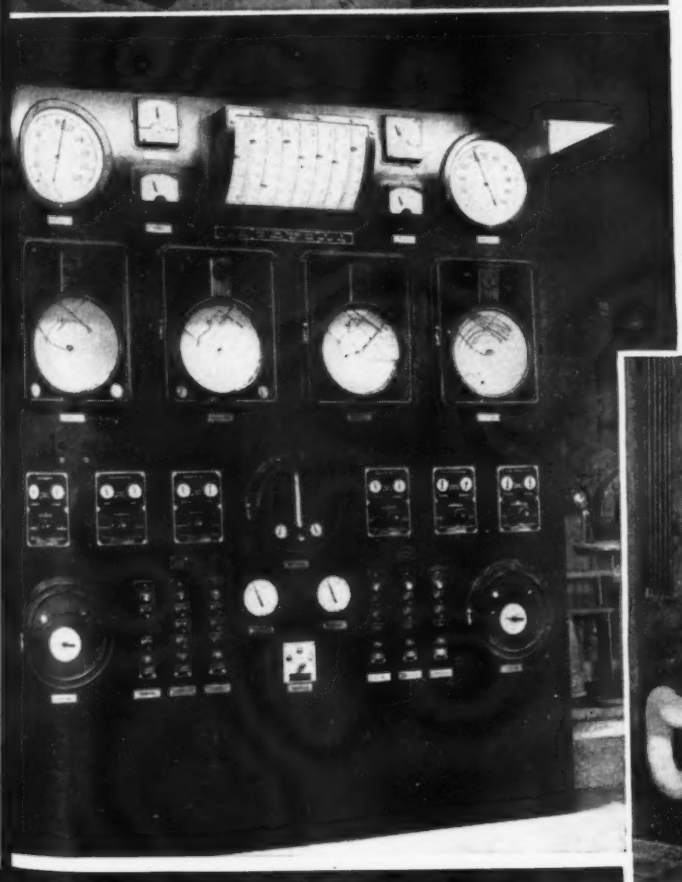


LEFT: Combustion Control, Three-element Feed Water Control and Superheated Steam Temperature Control for two 375,000 pound per hour pulverized coal fired boilers are coordinated on these Bailey Boiler Panels to insure safety and economy.

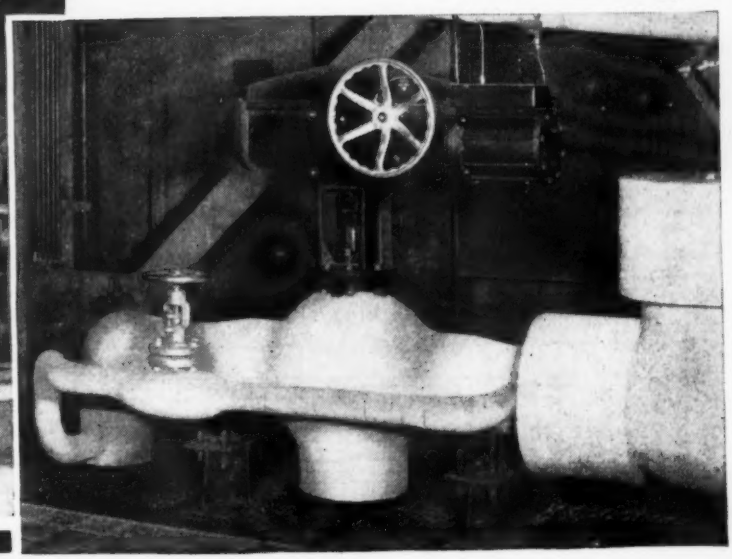
BELOW: Hotwell and Heater Levels in the Feed Water System for two 800,000 pound per hour pulverized coal fired boilers are automatically maintained at design values by this Bailey Pump Control Panel.



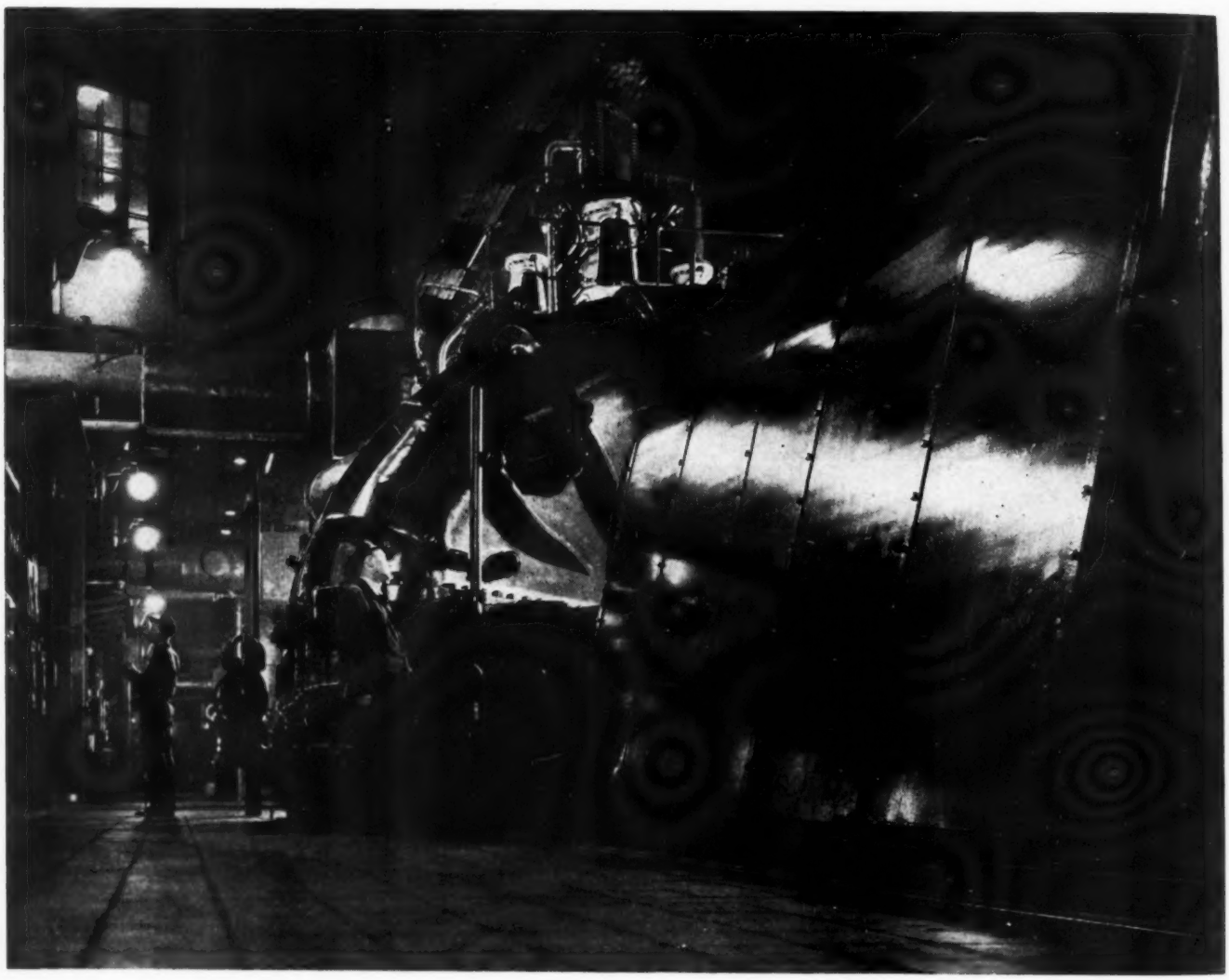


LEFT: This Bailey Control Panel in a synthetic rubber power plant provides for the use of waste gas as an auxiliary boiler fuel when and as it is available. Interlocks and fuel-air ratio controls insure safe operation.

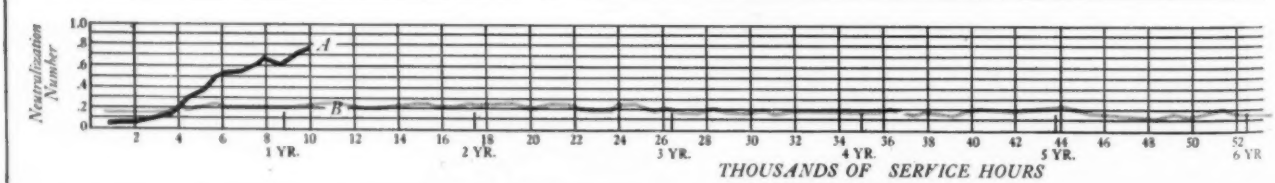
BELOW: This 8-inch Bailey Three-element Feed Water Control Valve regulates water input to equal steam output from a 700,000 pound per hour boiler, thereby maintaining a safe water level in the drum at all times.



Operating record of 40,000 KW proves again the greater



A—Conventional turbine oil, replaced after 10,000 hours. **B—Operating record of Gulfcrest Oil.**



turbine stability of

GULFCREST

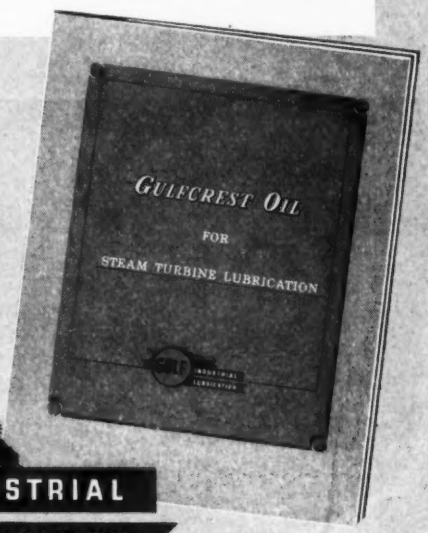
—the world's finest oil for steam turbine lubrication

OVER 73,000 hours in service and still providing excellent lubrication—that's the stability record established by Gulfcrest Oil in this 40,000 kw. turbine system! Note in the chart below that the neutralization number curve of Gulfcrest Oil stays at a very low level during and after this remarkably long service.

Here's the important reason for operating records like this with Gulfcrest Oil: This top quality oil is superrefined by the Alchlor Process, which not only weeds out the sludge formers (unsaturated hydrocarbons), but imparts to the oil greater ability to benefit from the addition of special inhibitors.

Write today for your copy of the new booklet which gives the full story of Gulfcrest Oil and of the Alchlor superrefining Process.

Send for your copy of this booklet



GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company
3800 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of your new booklet "Gulfcrest Oil for Steam Turbine Lubrication."

Name.....

Company.....

Title.....

Address.....

New Model Way

Power distribution problems are worked out quickly and accurately when you use Allis-Chalmers "Unit Sub Builder" Set to help with reconversion, expansion, plant modernization planning. Accurate scale models make it possible for you to *see* available equipment, *see* the various ways it can go together, *see* how the *right* unit substation will look in your plant.

1 YOU SEE WHAT'S AVAILABLE. Allis-Chalmers "Unit Sub Builder" Set contains accurate scale models of all A-C substation equipment. Visual planning is simple, practical, fast. You build the answers to your unit sub problems right on the top of your desk . . . without bogging down in charts, tables.

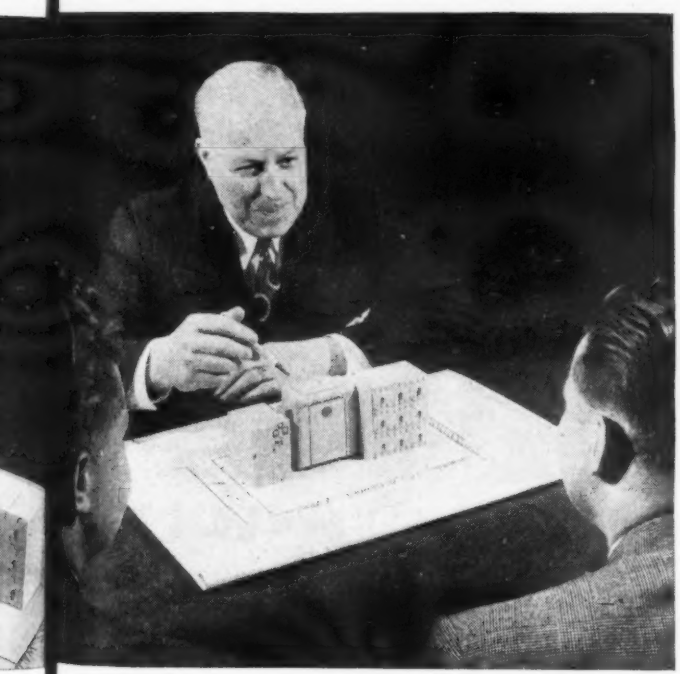
4 SLIDE RULE — designed to calculate secondary short circuit current — helps planner determine proper low voltage breakers. After checking load, he determines how many feeder breakers are needed. Here, low voltage unit is being built: first, bus transition, then, three 50,000 amp air circuit breakers.

5 COMPLETED MODEL unit substation is easily checked for final space requirements. By sketching a section of his plant on cross-section paper to the same scale as models — ½ in. to 1 ft, planner determines quickly and exactly how much space the unit substation will occupy. All guesswork is gone.

to Buy Unit Subs

2 HANDY "CHECK LIST" BOOK gives you the added safety of a double check. It helps in the selection of the proper transformer, high and low voltage systems, other considerations when planning a load center unit substation. Weights and dimensions of transformers and switchgear are given.

3 PROPER SELECTION of high voltage switchgear is important. Models show at a glance the large variety of equipment available. Here, unit sub planner selects vertical lift switchgear to get protection and flexibility. He uses drop collar throat to simplify connection to 1,000 kva dry-type transformer.



6 DECISIONS ARE MADE quickly and easily when Allis-Chalmers "Unit Sub Builder" Set is used to show various arrangements that will fulfill the power distribution needs of your plant. It's a simple matter for other men in your organization to visualize how the *right* unit sub will look when installed.

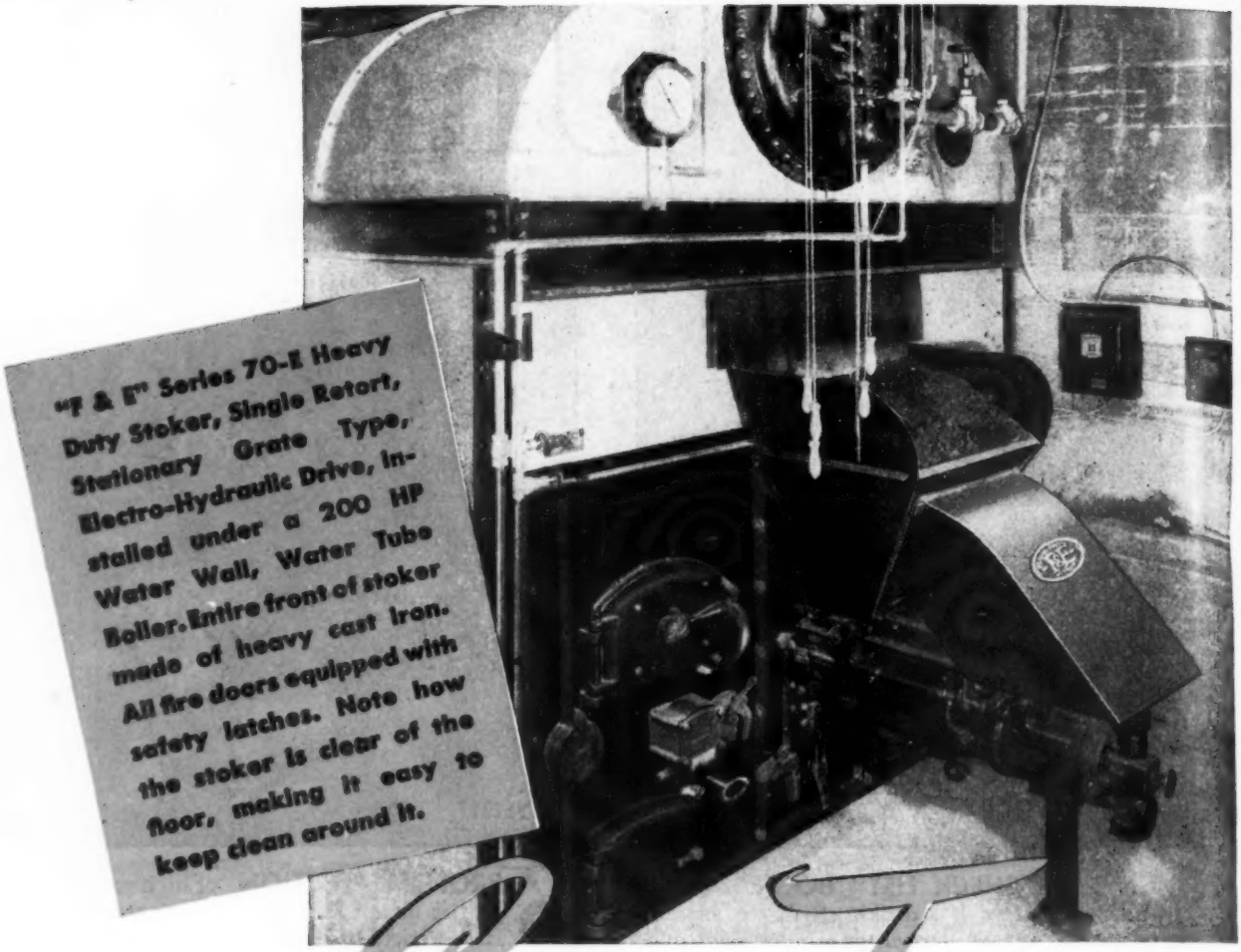
Work out your Unit Sub ideas with

ALLIS-CHALMERS

"Unit Sub Builder" Set

To see how the "Unit Sub Builder" Set can help in your unit substation planning, call your A-C district office for a showing. There's no obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

DETROIT PUBLIC LIBRARY



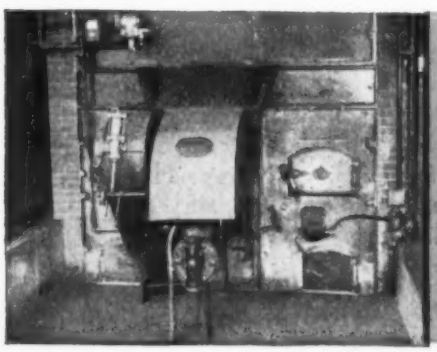
"F & E" Series 70-E Heavy Duty Stoker, Single Retort, Stationary Grate Type, Electro-Hydraulic Drive, installed under a 200 HP Water Wall, Water Tube Boiler. Entire front of stoker made of heavy cast iron. All fire doors equipped with safety latches. Note how the stoker is clear of the floor, making it easy to keep clean around it.

"F & E" SERIES 70-E UNDERFEED STOKERS

Sure-Fire

Powerful and positive in action, the Series 70-E Stoker with the "F & E" patented Electro-Hydraulic Drive will dependably feed and burn coal sufficient to generate up to 40,000 lbs. of steam per hour.

Recognized as the most simple and flexible . . . the most rugged and dependable stoker drive ever developed, the "F & E" Electro-Hydraulic Drive is trouble free under every fuel feeding condition. All working parts are fully enclosed and operate in oil. No pipes, valves or fittings to leak or give trouble.



Front view of "F & E" Series 70-E Electro-Hydraulic Drive Stoker, Unit Type, for capacities up to 18,000 lbs. of steam per hour. A constant speed electric motor operates the Electro-Hydraulic Drive, with power transmitted through a specially designed, high-duty, hydraulic gear pump, which in turn, supplies oil under pressure for operating the hydraulic cylinder and piston.

No gears, ratchets, shear pins or complicated mechanism to break down. "F & E" features include the interval timer governor that regulates Full Stroke, Full Speed ram action so essential to dependable steam generation. Result—*uninterrupted sure-fire* performance at all times!

Investigate "F & E" Stokers—check into the "F & E" combination of six engineered features that assure you dependable, *sure-fire* production of steam for your requirements.

FLYNN & EMRICH CO.

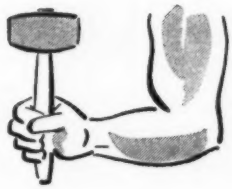
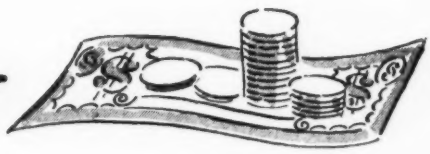
Established 1842

HOLLIDAY & SARATOGA STREETS, BALTIMORE 2, MARYLAND

Representatives in Principal Cities

UNDERFEED STOKERS

HYDRAULIC DRIVE AND STEAM DRIVE FOR BOILERS PRODUCING 10,000 TO 40,000 LBS. OF STEAM PER HOUR

Trade this  for this ; save and 

No more *forcing* of sheaves. Simple wrench operates Allis-Chalmers' "Magic-Grip"® — *fastest mounting and demounting sheave on the market.* Saves time, money.

SEE HOW QUICKLY, EASILY THIS NEW SHEAVE MOUNTS AND DEMOUNTS

1 Place sheave on shaft. Slides on smoothly because clearance is provided by expanded bushing. There's *no* hammering — *no* forcing! Complete sheave and bushing unit comes intact—ready for quick, easy mounting.

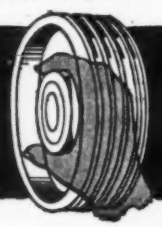
2 Align exactly, using straightedge, (It's easy with this free-sliding sheave.) Then tighten three cap-screws; sheave is locked to shaft, *grips like magic!* No set screws to damage the shaft. Write A-C for Bulletin B6310.

RECONVERTING?

GET THIS NEW FREE KIT!

To help you find out how your present equipment will fit into future production, A-C offers a new free "Reconversion Inventory Kit" — Fact Sheets and Check Lists to speed your appraisal of V-belt drives, electric motors, and centrifugal pumps. Applies to all makes. Call your A-C distributor or district office, or write Dept. 31, ALLIS-CHALMERS MFG., Milwaukee 1, Wisconsin.

A 1855

Allis-Chalmers Texrope "MAGIC-GRIP"  SHEAVES

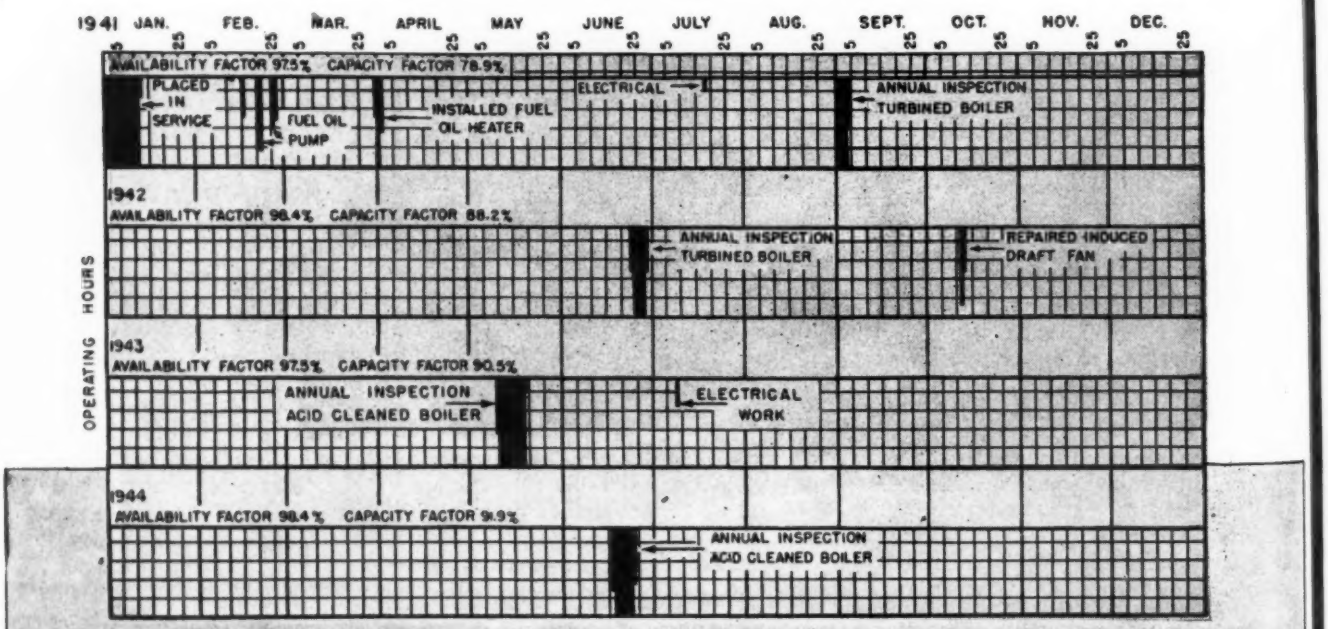
Availability Record

Foster Wheeler steam generator establishes outstanding record during 4 year period for The Dow Chemical Company.

CORRECT design, accurate shop fabrication and proper installation methods are responsible for an outstanding performance.

A Foster Wheeler, two drum, "D"-type steam generator, placed in service by The Dow Chemical Company in 1941 has established a 98% availability record over a four year test period. This boiler was designed for a maximum load of 150,000 lb. of steam per hour at 425 p.s.i., and final steam temperature of 735 deg. F.

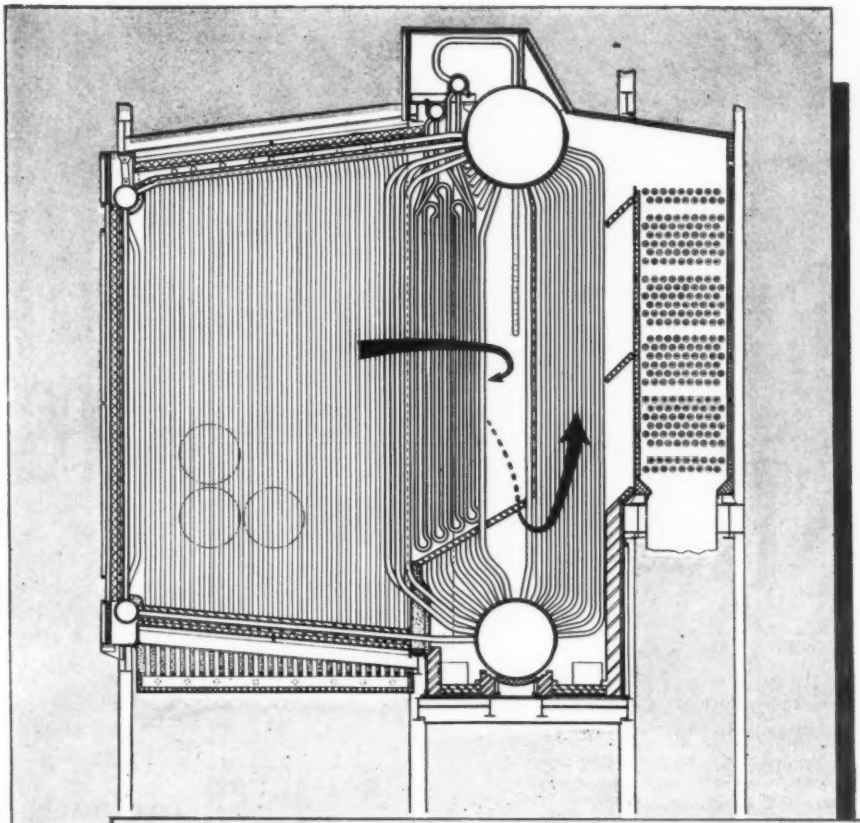
During the last two years the boiler was cleaned internally by the "Dowell" acid method developed by The Dow Chemical Company, the success of which is given in an article in the July issue of *Power Plant Engineering*.

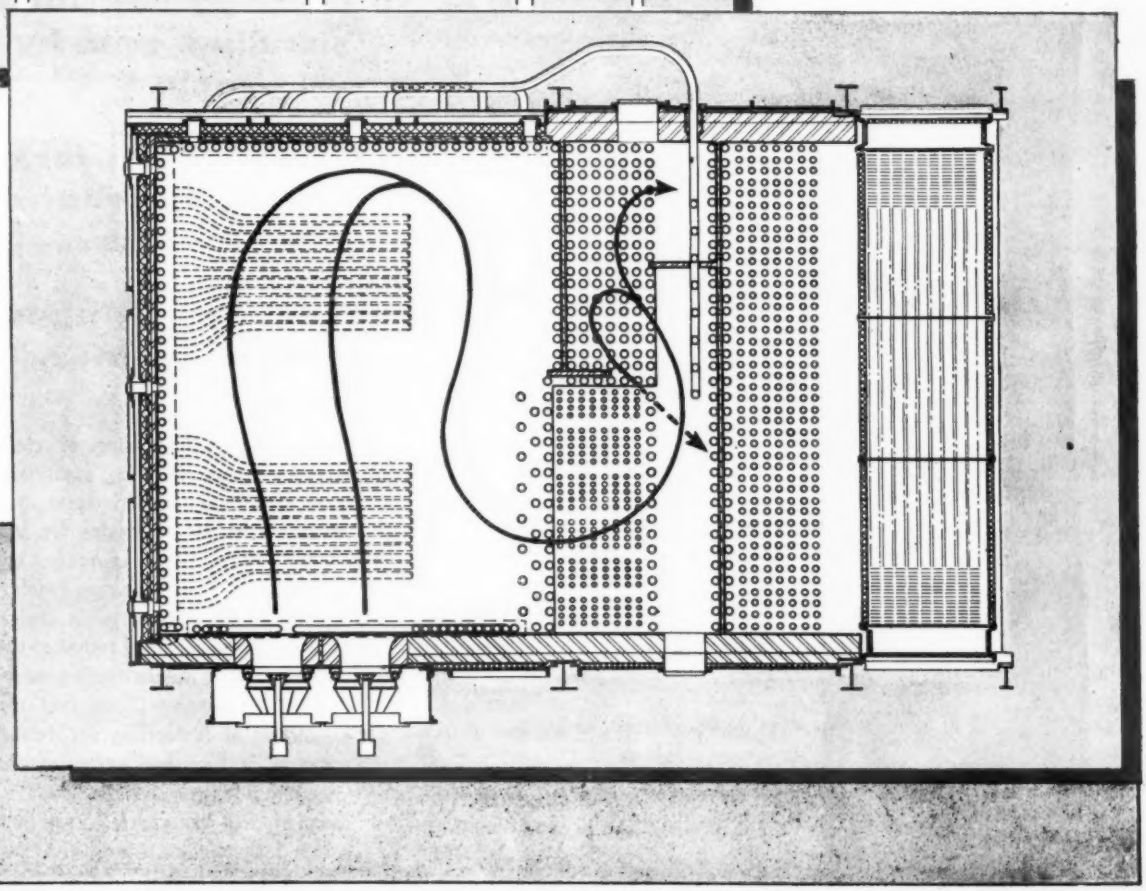

1941 JAN. FEB. MAR. APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
OPERATING HOURS
AVAILABILITY FACTOR 97.5% CAPACITY FACTOR 78.9%
PLACED IN SERVICE
FUEL OIL PUMP
INSTALLED FUEL OIL HEATER
ELECTRICAL
ANNUAL INSPECTION TURBINED BOILER
1942
AVAILABILITY FACTOR 98.4% CAPACITY FACTOR 88.2%
ANNUAL INSPECTION TURBINED BOILER
REPAIRED INDUCED DRAFT FAN
1943
AVAILABILITY FACTOR 97.5% CAPACITY FACTOR 90.5%
ANNUAL INSPECTION ACID CLEANED BOILER
ELECTRICAL WORK
1944
AVAILABILITY FACTOR 98.4% CAPACITY FACTOR 91.9%
ANNUAL INSPECTION ACID CLEANED BOILER

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

98% over Four Year Period





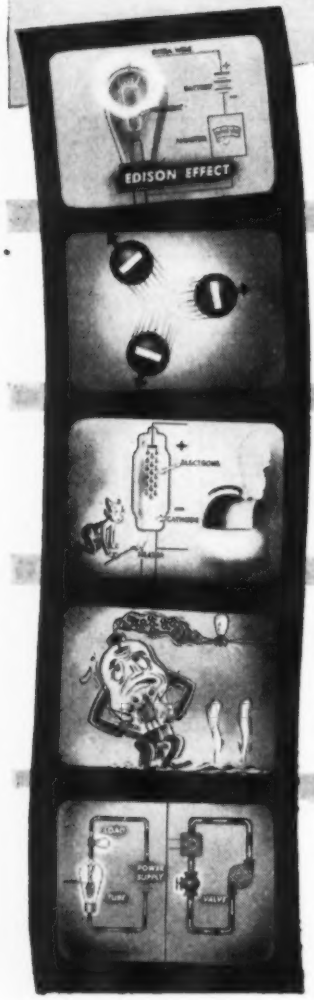
GENERAL ELECTRIC

Announces

A 12-PART TALKING SLIDEFILM COURSE in

INDUSTRIAL ELECTRONICS

THESE 5 ILLUSTRATIONS AND (RECORDED) CAPTIONS are typical of the simple, interest-arousing sequences. 100 in each slidefilm.



When the lamp is lighted and the filament glows, current flows through the extra wire, even though it is not connected with the filament itself. This phenomenon (Edison Effect) demonstrates the underlying principle of electronic tubes.

Electrons, being negatively charged particles, repel each other and hinder the flow of other electrons from cathode to anode. This repelling action is called "space-charge"—a factor of very great importance in electronic-tube design.

In some types of electronic tubes, we "boil" the electrons out of the cathode with heat, much as boiling water produces steam.

A gas-filled tube (phanotron) can be damaged if forced to operate before its cathode has been heated sufficiently to emit the required amount of electrons. To prevent such abuses, most electronic equipments have automatic timers built in to protect rectifier tubes.

In our electric circuit, we use a second voltage supply called the control, or grid, voltage. It performs much the same function as the control handle on the valve in a hydraulic circuit.

. . visualized **for easy understanding, even by non-technical people**

. . packaged **for easy instruction, using your own "home-talent" leaders**

. . practical **up-to-the-minute subject matter, technically authentic**

Now, an understanding of electronics as applied in industry can be built up, right within your organization, using the ingenious techniques of *visual instruction* that have proved so successful for wartime training. Every sequence of this 12-part course has been put to test on groups of widely different education levels. Educators have joined practical plant executives in praising its combination of *easy understanding* and *technical accuracy*.

As you follow the instruction manual, the sessions almost "conduct themselves," so that no great experience in organizing or instructing people is necessary. Everything essential is furnished except a sound slidefilm projector (35 mm, 33½ rpm), screen, and a meeting place. Upon completion of the course, your people will have a well-rounded acquaintance with electronic devices, tubes, circuits, and applications.

ALL THESE WILL BENEFIT

As electronic apparatus is applied more and more widely to industrial plants and processes, more and more of your people—from managers to maintenance men—will find their work depending upon electronics in a very practical way. Some of them must learn to service this equipment. Others will be better equipped to get the most out of electronic equipment when it is no longer "all a mystery" to them.

PLANT ELECTRICIANS and maintenance men will find the course understandable, even if their knowledge of electrical theory is limited. In learning about electronics and its application, they'll get a background of fundamentals of electricity, too.

PLANT AND DESIGNING ENGINEERS will find the course stimulating in suggesting practical electronic applications to improve processes or products.

PRODUCTION MANAGERS and foremen will get a clearer concept of the workings of equipment for which they are responsible. New process control ideas may also be suggested.

EXECUTIVE MANAGEMENT and purchasing agents can get a clearer concept of practical electronic possibilities. They will be in a better position to consider and approve recommendations.

SALESMEN selling electronic products will be better equipped to talk to their customers.

Note: *ELECTRICAL UTILITY COMPANIES* and electrical associations in many communities are organizing inter-company groups for this course of instruction. You may want to check with your local utility on this point.

THESE ARE THE 12 SUBJECTS OF INDIVIDUAL FILMS AND LESSON BOOKS

1. Harnessing the Electron
2. Electronic Tubes as Rectifiers
3. Grid Control of Electronic Tubes
4. Fundamentals of Electricity, Part I
5. Fundamentals of Electricity, Part II
6. Electronic Relay Systems
7. Electronic Rectifier Equipment
8. Thy-mo-trol (Thyratron Motor Control)
9. Electronic Control of A-c Power
10. Electronic Frequency Changing
11. Photoelectric Systems
12. Electronics, Today and Tomorrow

GENERAL ELECTRIC

BUY ALL THE BONDS YOU CAN—*AND KEEP ALL YOU BUY*

Here's what you get

12 SLIDEFILMS AND RECORDED TALKS—each about ½ hour long

300 REVIEW BOOKLETS—25 sets of 12 individual lessons, keyed to the slidefilms

1 INSTRUCTOR'S MANUAL—a 140-page book with hundreds of illustrations and detailed steps for conducting the course

1 CARRYING CASE—attractive and strongly built, it holds records, films, and manuals

THE PRICE—for the complete "package" as above, $100; *extra* manuals, $3; *extra* sets of 12 *review booklets*, $2

ORDERS—can be placed through any local G-E office, or use the coupon below.

General Electric Company
Apparatus Dept., Section C685-13
Schenectady 5, N. Y.

—Enclosed is our order for ..... complete INDUSTRIAL ELECTRONICS courses at $100 each (May be returned without charge if you are not fully satisfied.)

—When could someone in our organization see a showing of one of these lessons and examine the complete kit?

Name.....

Company.....

Address.....

8930

"On the line" 94.3%

Average Record of

This 3-year record of 5 C-E Steam Generating Units operating under war-time service demands in four large utility plants testifies to the kind of stay-on-the-line performance that is the primary objective of C-E design.

CUMBERLAND STATION

THE POTOMAC EDISION CO.
CUMBERLAND, MD.

•

Capacity—312,500 lb of steam per hr
Design Pressure—925 psi
Total Steam Temp.— 830 F

UNSCHEDULED OUTAGE
1.06% IN 3 YEARS

USE FACTOR
98.2%

WESTPORT STATION
2 UNITS

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY OF BALTIMORE
BALTIMORE, MD.

•

Capacity—285,000 lb of steam per hr (each)
Design Pressure—1450 psi
Total Steam Temp.—915 F

UNSCHEDULED OUTAGE
1.28% (Unit No. 1)
IN 3 YEARS

UNSCHEDULED OUTAGE
1.0% (Unit No. 2)
IN 3 YEARS

USE FACTOR
92.5%
AVERAGE BOTH UNITS

of the time for 3 years

5 C-E Steam Generating Units in 4 Plants

LOGAN STATION
APPALACHIAN ELEC. POWER CO.
LOGAN, W. VA.

•

Capacity—1,000,000 lb of steam per hr
Design Pressure—1425 psi
Total Seam Temp.—925 F

UNSCHEDULED OUTAGE
1.8% IN 3 YEARS
USE FACTOR
93.6%

MANCHESTER STREET STATION
NARRAGANSETT ELECTRIC CO.
PROVIDENCE, R. I.

•

Capacity—430,000 lb of steam per hr
Design Pressure—1350 psi
Total Steam Temp.—915 F

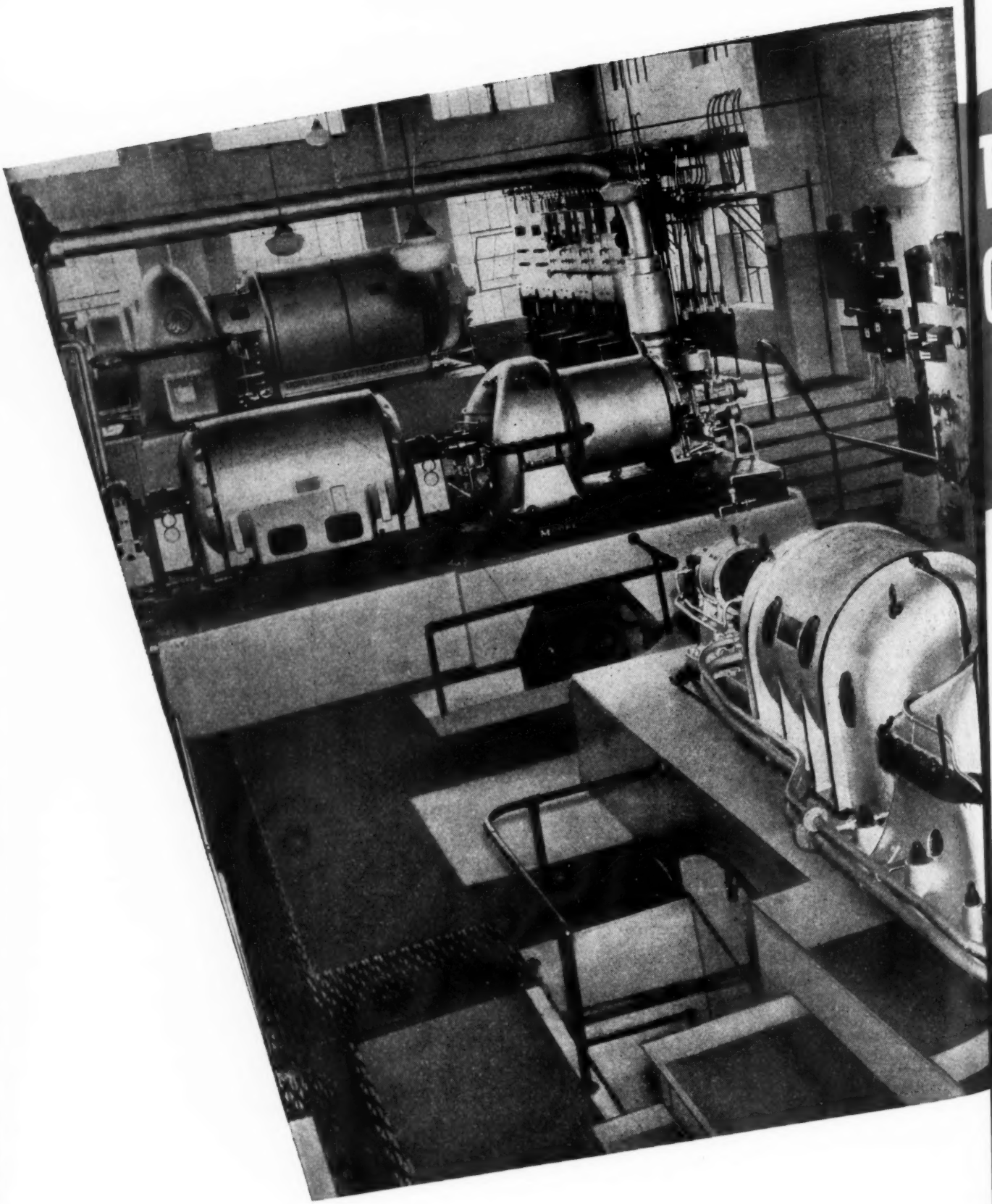
UNSCHEDULED OUTAGE
0.98% IN 3 YEARS
USE FACTOR
93%

ll of these service records have been reviously presented in graph form, howing when the outages occurred and hy. They should be interesting mate- ial for the perusal of any utility engi- eer. If you missed them when they ppeared as individual advertisements uring the past few months, we shall e glad to send you a complete set.

C-E

OMBUSTION ENGINEERING

00 MADISON AVENUE • NEW YORK 16, N. Y.



TUNE IN THE
TEXACO STAR THEATRE
WITH JAMES MELTON
EVERY SUNDAY NIGHT
— CBS

TEXACO

TEXACO

THE BEST TURBINE OIL is the oil that . . .

★ **Frees itself of air and water**

★ **Prevents oxidation and rust**

★ **Eliminates sludge and gum tendencies**

TEXACO *Regal Oils (R & O)* are the same *Regal Oils* that have been world-famous for so many years, *improved* by additives that assure the highest possible resistance to oxidation, rusting and foaming. Whatever the turbine size or type, you can depend on *Texaco Regal Oils (R & O)* to keep the system clean and bearing temperatures normal . . . to assure smooth, sensitive governor action, reduce maintenance costs and prolong turbine life.

Texaco Regal Oils (R & O) are typical examples of petroleum products improved through The Texas Company's constant research. They are made in one of the world's largest refineries from carefully selected crudes processed by modern Texaco methods to provide efficient and economical turbine operation. Their production is 100% Texaco controlled from well to finished product to assure absolute uniformity.

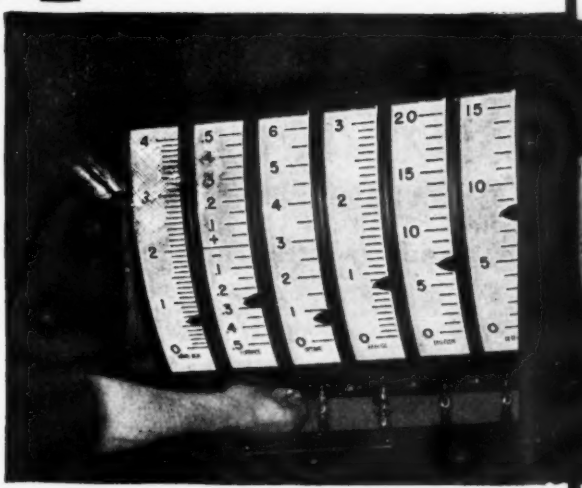
For suggestions on the proper care of oil and maintenance of turbine systems, call on Texaco Lubrication Engineering Service, available through more than 2300 Texaco distributing plants in the 48 States. Get in touch with the nearest one, or write to:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

REGAL OILS (R & O)

FOR ALL TURBINES

YOU GET



Just tilt the bezel flange and all zero adjustment knobs, connections, etc., are at your finger tips.

LL OF THESE FEATURES

In The Republic Multi-Point Draft and Pressure Gage

1. **EASY TO OPERATE:** All adjustments can be made from the front of the gage regardless of whether it be flush or projected mounted. On the flush mounted gage a bezel flange, which tilts back, conceals the zero adjusting knobs, pipe connections, mounting bolts, etc.

2. **INDIVIDUAL UNITS:** Each draft or pressure element is individually housed in a die cast case forming a complete compact unit.

3. **UNITS EASILY REMOVED:** The individual units can be removed from the front of the gage as you would remove a book from a shelf. This can be easily and quickly done without interfering with the operation of any other unit.

4. **EASY TO MAINTAIN:** Because each element is a complete unit in itself which can be easily removed, maintenance is greatly simplified.

5. **INDIVIDUAL ILLUMINATION:** Each scale is individually illuminated from the back by a light located outside of the element housing.

6. **UNIFORM SIZE:** All units are of one standard size which permits new units to be added or interchanged as required.

7. **ALL STANDARD RANGES:** Elements are supplied for all standard ranges of draft, pressure or differential.

8. **SENSITIVE DIAPHRAGM:** All elements, except those for high pressures, are actuated by an extremely sensitive bellows type of diaphragm.

9. **MULTIPLE UNITS:** Any number of units of draft, pressure or differential may be combined in one multi-point gage which is supplied for either flush or projected mounting.

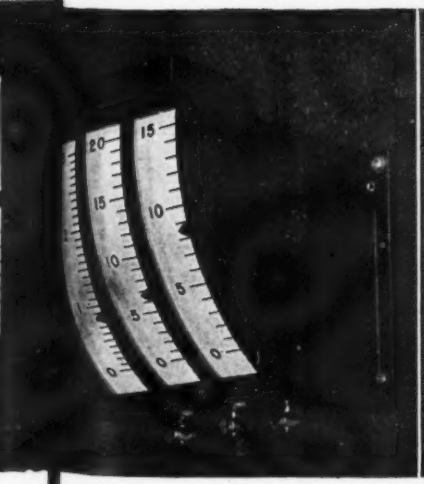
10. **FLOW, CO_2, TEMPERATURE:** Developed primarily to indicate drafts, pressures and differentials, the Republic multi-point gage can also be made to indicate other quantities such as flow, CO_2, temperature, liquid level, etc. In each case the corresponding standard Republic instrument is used.

The sectional view shown on the opposite page illustrates the extreme simplicity and compactness of the Republic Multi-Point Draft and Pressure Gage. Every detail has been designed to assure ease of maintenance and continuous operation as well as accuracy and sensitivity.

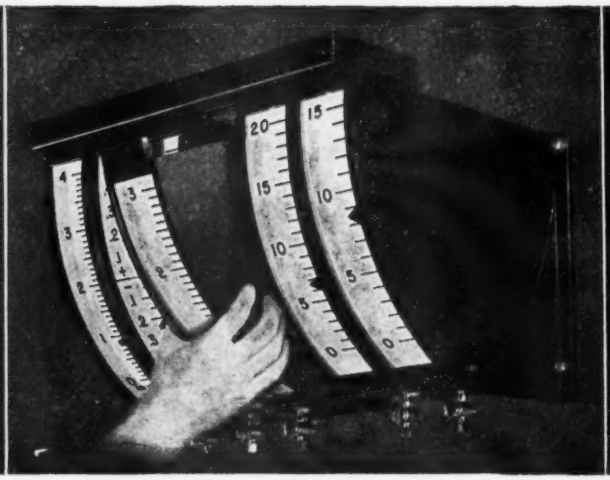
Write for a copy of Bulletin No. 802

REPUBLIC FLOW METERS CO.

2222 DIVERSEY PKWY. **CHICAGO 47, ILLINOIS**

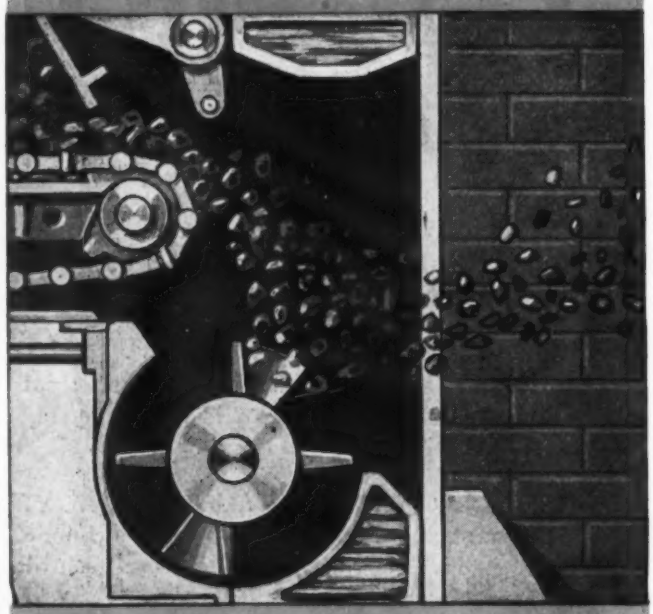


Supplied for either flush or projected mounting.



Any unit can be easily removed from the front without disturbing any other unit.

Each element is a complete, compact, sealed unit.



MORE STEAM at LOWER COST

LOOKING FOR a way to trim your fuel costs and boiler room operating expenses? Then you'll surely be interested in every feature of the Æ Perfect Spread Stoker—from its "streamlining with a purpose" to its "crossfiring" principle of combustion.

This modern, dependable stoker efficiently burns any kind or grade of solid fuel, wet or dry, including by-products and plant refuse. Maximum heat from every pound of fuel means more steam at very worthwhile savings. In operation, the stoker is extremely clean and quiet, answering steam demands instantly. It puts an end to many wasteful boiler room practices.

You may find in these and other important advantages the way to cut *your* fuel bills and boost operating efficiency. Write today for the new Æ Perfect Spread Stoker bulletin.

Overthrow ROTOR
SPREADS PERFECT FUEL BED

Over-the-rotor feed covers the entire grate area with a "Perfect" fuel bed and causes less wear on the rotor and housing. The uniquely designed and balanced Æ rotor spreads fuel perfectly, the fines burning in suspension and the heavier particles dropping to the grate for thorough combustion. This rotor is an exclusive feature not found in any other stoker.

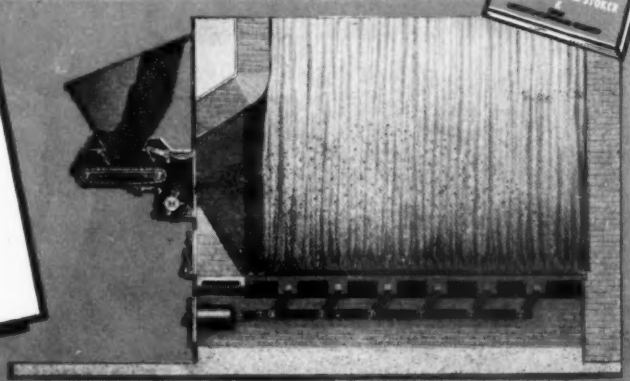
Cooperate with the "National Fuel Efficiency Program" of the U. S. Bureau of Mines.

If Your Steam Requirements Call for 175 H. P. up to 200,000 lbs. per hour—

YOU NEED THIS BULLETIN

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.

Æ PERFECT SPREAD STOKER



Other Æ Products: Æ-Taylor Stokers, Lo-Bel Boilers, Marine Deck Auxiliaries, Non-Slam Feed Pumps, Diamond Face Grinders

AMERICAN ENGINEERING COMPANY

Subsidiaries: COCHRANE CORPORATION, FARADAY ELECTRIC CORPORATION

PHILADELPHIA 25, PENNSYLVANIA

A SURE WAY TO BE SURE YOU'RE RIGHT

HOW MANY types and makes of stokers should you consider when specifying new power plant equipment? Two? Four? Eight? To be absolutely *sure* you're right, you'll no doubt want *all* the information you can possibly get on *all* the latest stokers.

That's why we believe you will want to know about the *improved* Taylor Stoker. It is not an untried, untested stoker, but one with a solid 39-year background of highly efficient service all over the world. Now, sweeping improvements have been made that rank it as a stand-out stoker for dependable, low cost steam generation . . . based on *today's* requirements . . . and built to *tomorrow's* needs.

You'll get a great deal of valuable information from the new Type "R" Taylor Stoker booklet, which details every improved feature and its advantages to *you*. Write for it *today*.

IF YOUR Steam Requirements Call for 20,000 to 500,000 lbs. per hour—

YOU NEED THIS BOOKLET

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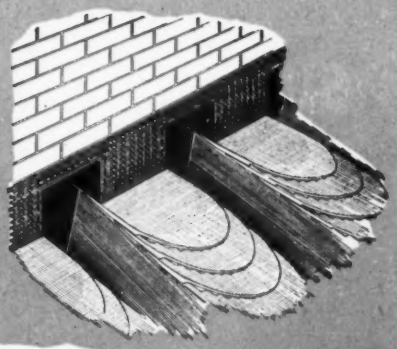
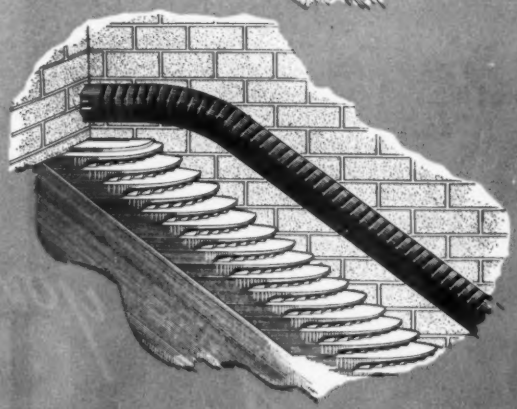
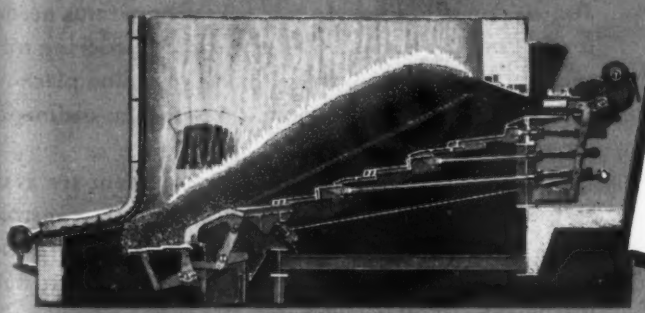
ANOTHER IMPROVEMENT IN THE TYPE "R" TAYLOR STOKER





AIR COOLING REDUCES SLAG FORMATION

Front Wall Air Boxes, Side Wall Air Nozzles and Half Tuyeres of the Taylor Stoker discharge continuous, uniform air screens that reduce slag and clinker formation on furnace walls. This increases operating efficiency and economy.



Æ TAYLOR STOKERS

AIR-COOLED & WATER-COOLED

Other Æ Products: Æ-Parfect Spread Stoker, Lo-Hed Hoists, Marine Deck Auxiliaries, Hale-Shaw Fluid Power, Diamond Face Grinders

AMERICAN ENGINEERING COMPANY

Subsidiaries: COCHRANE CORPORATION, FARADAY ELECTRIC CORPORATION

PHILADELPHIA 25, PENNSYLVANIA

A COMPLETE

substation and distribution system

ORDERED • INSTALLED • OPERATED AS ONE COMPACT UNIT

Here is a new heart for your building's power distribution system—*the Westinghouse Close-Coupled Air-Cooled Power Center.* It saves time in ordering, installation and operation. It eliminates piecemeal assembly on the job! It can be installed *anywhere* indoors without a vault—because it is completely air-cooled. It's lighter, too. Install it anywhere in the building with complete safety.

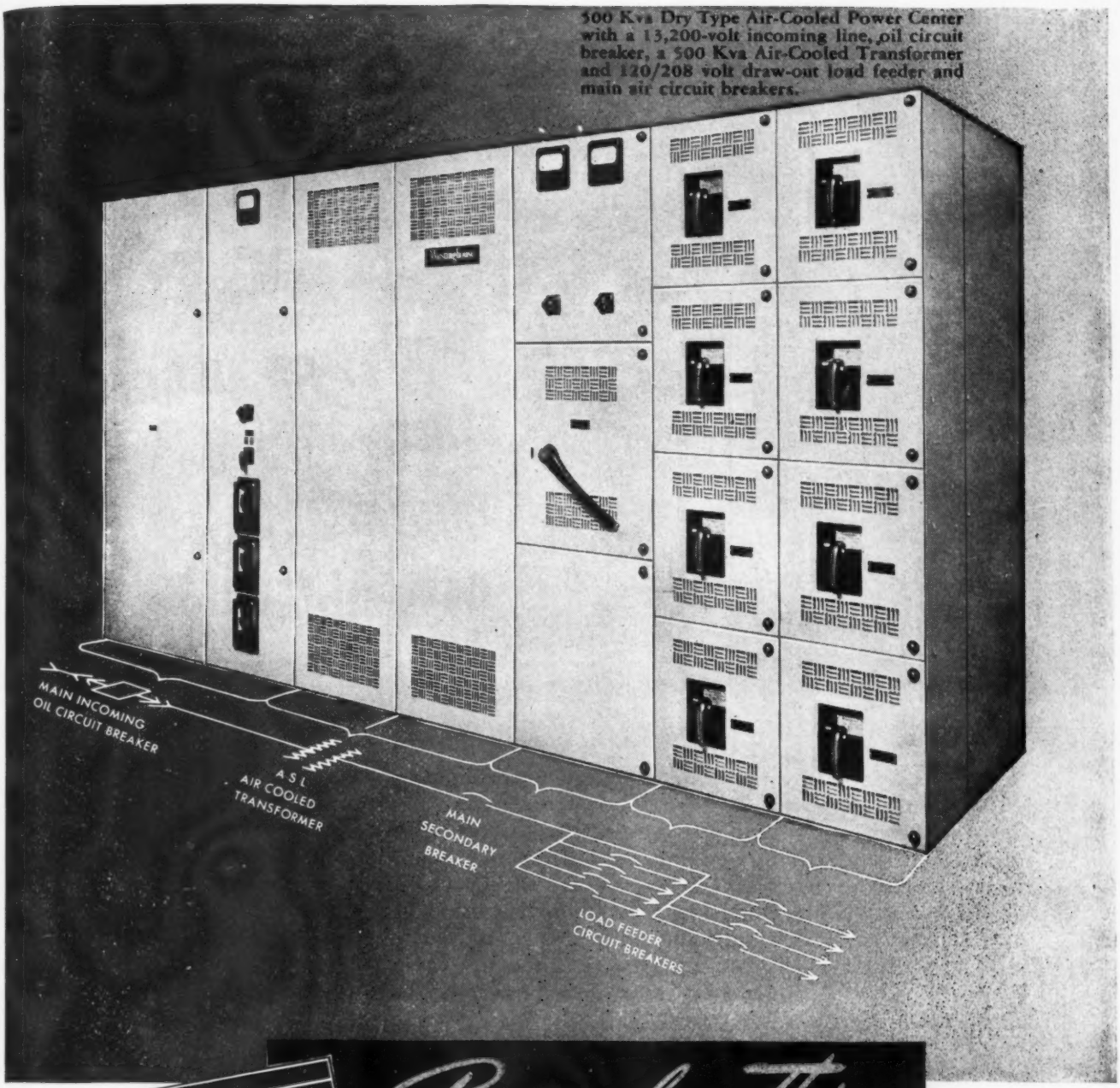
This complete station assembly results in substantial savings in materials and labor, and cuts service interruptions. It permits location of the Power Center at or near the centers of load.

The Westinghouse Air-Cooled Power Center is only one item of the complete equipment Westinghouse can supply. Others are: motors, control, circuit breakers, panelboards, lighting, elevators, Precipitron and air conditioning—in fact, all the apparatus needed for any building's electrical system. By ordering from *one* supplier, you place responsibility in one place . . . save time in ordering, installation and co-ordination for operation.

Complete specifications on all equipment are available to help you PLAN NOW for postwar construction. Phone your Westinghouse Office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94681

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



500 Kva Dry Type Air-Cooled Power Center with a 13,200-volt incoming line, oil circuit breaker, a 500 Kva Air-Cooled Transformer and 120/208 volt draw-out load feeder and main air circuit breakers.

Blueprint FOR TOMORROW'S NEEDS! **Now!**

Remember This:

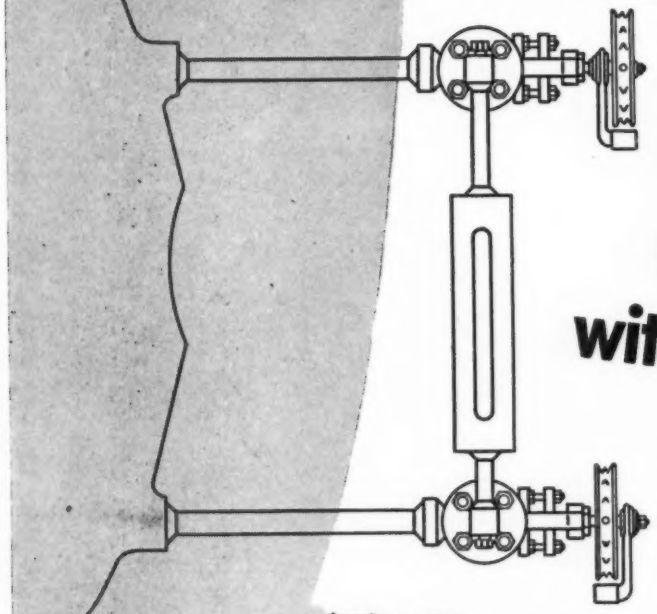
Westinghouse Air-Cooled Power Centers pay for themselves by

- Eliminating fireproof vaults
- Reducing installation costs
- Saving floor space
- Permitting location at center of load
- Providing better voltage regulation
- Safer operation and lower maintenance

Call your Westinghouse representative today for advice and practical help in laying out your postwar power and lighting distribution systems. It pays to *blueprint now for tomorrow's needs.*

AIR-COOLED POWER CENTERS FOR BUILDINGS

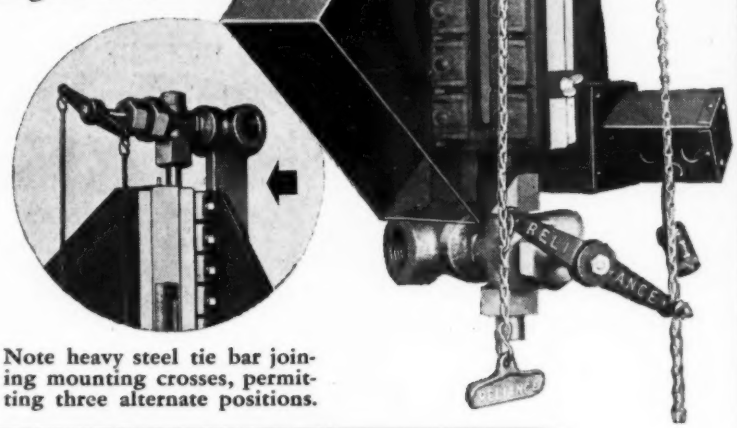
FOR YOUR DIRECT-TO-BOILER GAGES



Reliance is ready, as usual with sturdy, all-welded complete gage assemblies

Where high pressure boiler arrangement dictates the use of water gages connected direct to the drum, you're wise to plan for the greatest safety with gage equipment correctly engineered for the purpose. A Reliance completely welded assembly, with valves firmly spaced by a welded bar connecting lower and upper crosses, makes a substantial unit for moderate pressures. Assembly illustrated (right) is for pressures up to 600 lbs. Reliance Water Gages are available also for pressures to 2000 lbs., in extra-heavy design, with welding necks and flange connections welded to insert nipples. These super duty units are individually engineered to meet your specific requirements.

When new techniques are added to boiler gage practice . . . Reliance is foremost in meeting them with technically correct applications. Write for information.



Note heavy steel tie bar joining mounting crosses, permitting three alternate positions.

BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

It delivers more Horsepower than any belt ever built!

GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM-Specified Compass 250 Steel Cable Belt for Heavy-Duty Drives
The Goodyear Compass Steel Cable Belt is bodied with multi-strand airplane-type cable spiralled continuously without a splice. Cable on opposing sides of belt axis is twisted in opposite directions to insure true running.
LEFT-LAY STEEL CABLE
RIGHT-LAY STEEL CABLE
GOODYEAR
THE GREATEST NAME IN RUBBER

That's a broad statement — but every word of it's true about Goodyear's **Compass** 250 Steel Cable Belt. *This revolutionary new belt is capable of transmitting up to 37 horsepower per inch of width.*

What does this mean to you? Briefly, that you can now have more compact, more efficient drives with unusually high power-load capacities at both extremely slow and fast operating speeds.

This is possible because the new **Compass** belt is sinewed with a load-carrying core of finely stranded, high-tensile, endless steel cables, enclosed in a sturdy rubberized-fabric envelope that protects the cables from external wear. So strong is this unique, exclusive Goodyear construction, **Compass** 250 has TWICE the horsepower rating, width for width, of the best belts now available — and far longer life. In addition, **Compass** 250 is the first and only *stretchless* belt.

During the past year, several hundred **Compass** 250 belts have proved their superiority under tough wartime conditions—at belt speeds ranging from 430 to 10,000 F.P.M. In the low-speed ranges, **Compass** 250 can be used advantageously to replace chain drives.

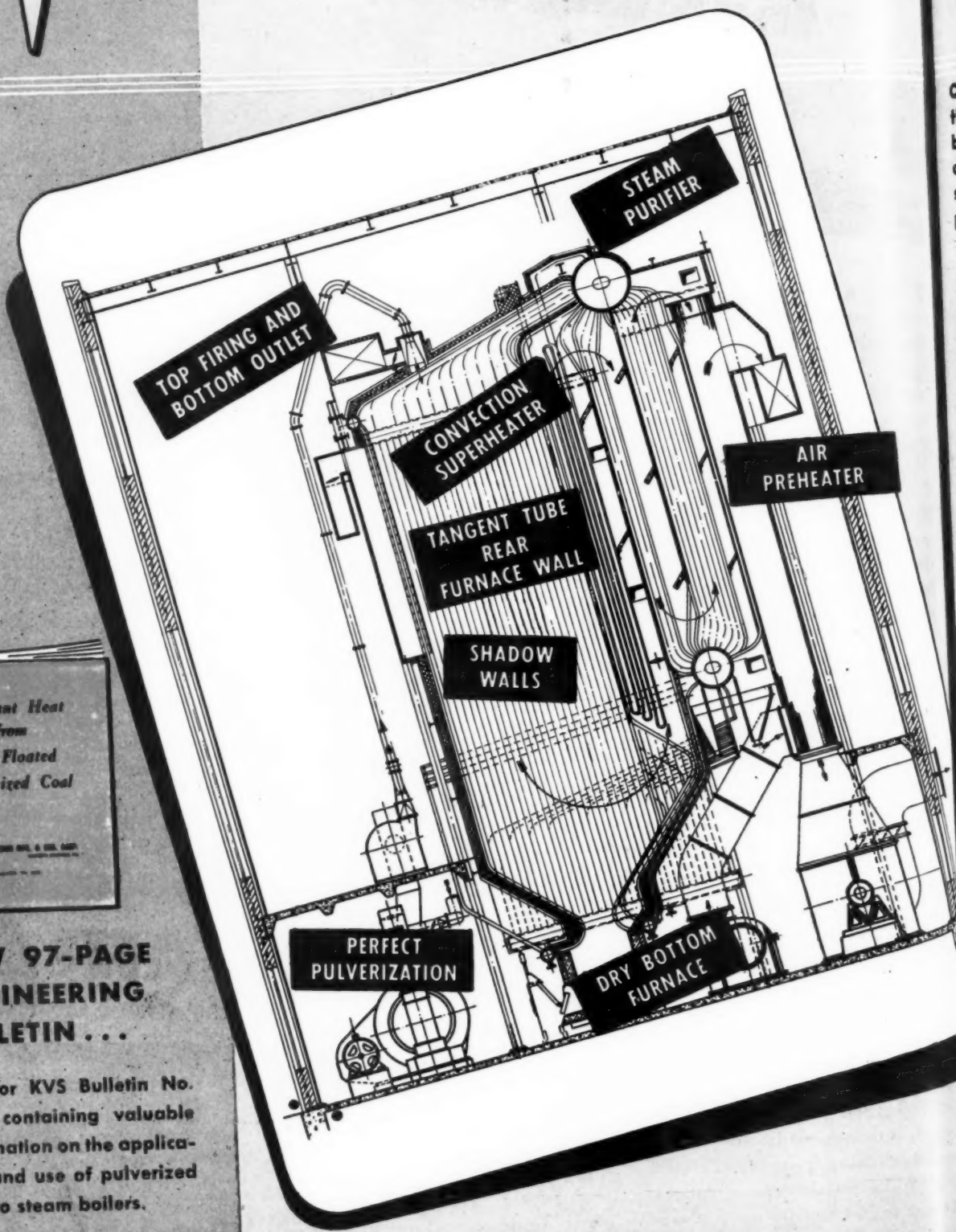
You'll want to know more about this revolutionary new belt. For complete details, consult the G.T.M. — Goodyear Technical Man — or write: Goodyear, Akron 16, Ohio or Los Angeles 54, California.

FOR HOSE, BELTING, PACKING, MOLDED RUBBER GOODS built to the world's highest quality standard, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass—T.M. The Goodyear Tire & Rubber Company

KVS

STEAM GENERATING E
PERFORMANCE P



NEW 97-PAGE ENGINEERING BULLETIN . . .

Ask for KVS Bulletin No. 44-B containing valuable information on the application and use of pulverized coal to steam boilers.

N EQUIPMENT . . . . . HAS BEEN CE PROVED *for Efficiency . . and Low Cost Operation*

Convection type steam generating units of the type shown here are designed and built by KVS for operation on the full range of coals including anthracite. They are designed and built for any capacities, pressures and steam temperatures.

TOP FIRING AND BOTTOM OUTLET

This design provides better combustion control because it is not necessary to "fight" the coal being burned. Even distribution of radiant heat is attained over furnace area. Through the use of the KVS Pulverizer which assures proper coal preparation, and with bottom outlet, carbon loss is completely controlled.

STEAM PURIFIER

A highly efficient means of purifying steam is provided by the KVS Steam Purifier. Less than one-half of one part per million of impurities is carried over.

CONVECTION SUPERHEATER

The KVS Superheater in this steam generator unit is damper controlled and so designed as to attain uniform final steam temperatures over entire operating range.

TANGENT TUBE REAR FURNACE WALL

This design reduces refractory to absolute minimum and affords greater back surface area, minimizing soot or slag accumulation.

SHADOW WALLS

Increased heat absorbing surface is provided by KVS Water Walls, assuring a clean furnace and avoiding refractory maintenance.

AIR PREHEATER

This component is of compact design and is included in the boiler structure itself.

DRY BOTTOM FURNACE

Concentration of heat is eliminated in this feature of KVS design and tube failures thereby minimized.

PERFECT PULVERIZATION

The KVS Integral Drive Tube Mill provides perfect pulverization controlled by air separation. This unit assures proper preparation of all grades of coal at low power and maintenance costs.

KVS ENGINEERING

KVS steam generating equipment has been performance-proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

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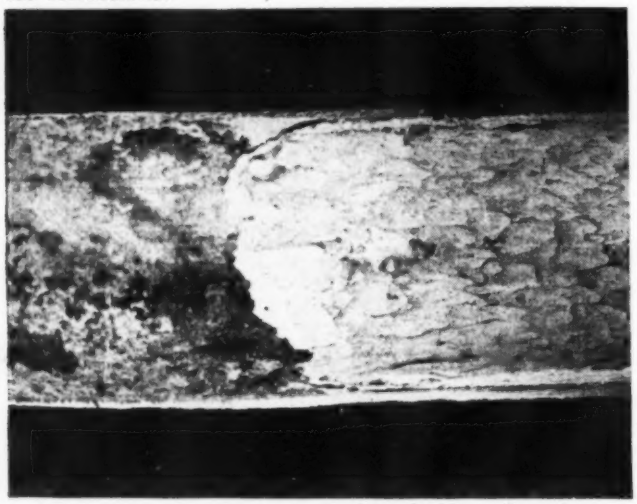
Scovill Tube News

Vol. 3 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 3

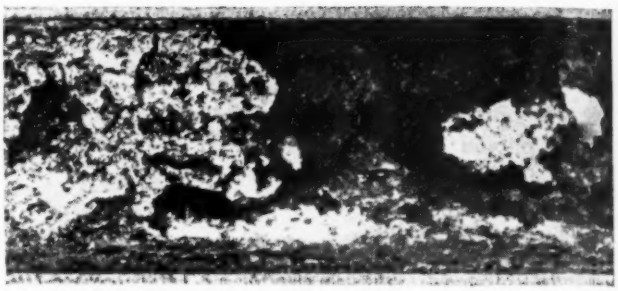
Thin Protective Films vs. Heavy Scales on Tube Surfaces

It is a well-established fact that the corrosion resistance of heat exchanger tubes bears a direct relationship to their ability to form and maintain protective films over their surfaces under any given set of service conditions. The protection afforded by films may vary considerably, depending upon the particular environment under which the tubes must serve. Under certain conditions, films offer full protection indefinitely and no visible corrosion of the metal results; in other cases, intermediate degrees of protection are obtained, while under extreme conditions, films may not form at all or once formed may undergo rapid and complete breakdown, resulting in relatively rapid destruction of the tube through corrosion.

Natural protective films which form over metal surfaces are characterized by their thinness, often only one or two molecules in thickness, and their continuity or non-porous nature. Such films are often invisible. They may be composed simply of oxides of the metals but more often films of more complex compounds may be equally protective under certain service conditions.



Heavy calcium carbonate scale on inside surface of heat exchanger tube.



Thick discontinuous sulphide scale on inside surface of heat exchanger tube removed from an oil refining unit.

In contrast to the protective value of thin films on metal surfaces, heavy or relatively thick deposits or scale which are allowed to build up on tube walls offer less satisfactory protection against corrosion and often accelerate corrosion to a marked degree. In addition to their deleterious effect on corrosion, heavy scaling of heat exchanger tubes materially reduces heat transfer with a resultant drop in efficiency of the unit.

The increasing thickness of deposits on tubes over a period of time may result chiefly from corrosion products formed as a result of attack of the metal by the medium in contact with the tube. Continued growth of this kind indicates that the metal under that particular environment has not been able to form a perfect protective coating to inhibit or prevent further attack. Very often, heavy scaling of tubes is not due to corrosion of the tube material but to chemical compounds, such as calcium carbonate and calcium sulphate, which are deposited or laid down by the circulating waters; under certain operating conditions and in contact with some types of circulating water, scaling of this kind may build up rapidly.

Heavy scaling of heat exchanger tubes may promote or accelerate corrosion in various ways. For example, such deposits are of a porous nature and therefore non-protective, and permit seepage of corrosive

media through the scale to the metal surface where various types of corrosive action can be set up. Heavy scales are also brittle and consequently are liable to crack or flake off, exposing areas of the tube wall to the action of the circulating media. One of the most serious consequences of heavy scale formation on tubes, however, is directly associated with a resulting increase in tube wall temperature, due to interference of the scale with efficient heat transfer through the tube wall. It is generally recognized that corrosion is accelerated with increasing temperature and a moderate temperature rise of 10°C. may actually double the corrosion rate. Under any service, therefore, it is important to maintain as low a tube wall temperature as conditions will allow.

As an illustration of possible severe corrosion resulting from heavy scaling, a case may be cited in which a heat exchanger is operating with scale-forming cooling water passing through the tubes and hydrocarbon vapors containing active sulphur compounds circulating around the outside of the tubes. During the initial period of operation, the water side of the tube would be relatively free from scale and the tube wall temperature would approach that of the cooling water; as operation proceeded and an insulating scale built up on the inside tube surface, the tube wall temperature would then approach that of the hydrocarbon vapors and corrosion at the vapor side by the active sulphur compounds would be very considerably accelerated. Dezincification of Muntz Metal, uninhibited Admiralty Metal and occasionally even Red Brass tubes has often been experienced beneath heavy deposits of scale, due primarily to the relatively high tube wall temperature caused by the insulating layer of scale.

Various preventative measures may be taken to minimize tube failures directly attributable to scale formations on the tube surfaces. Chemical treatment of cooling waters has been successful in many installations for the purpose of holding in solution scale-forming salts which would normally precipitate out on the metal surfaces. Water treatment may also aid in minimizing corrosion of the tube metal. Neutralization of vapors, gases, etc. by specific reagents has also been used to reduce corrosion and prevent the growth of deposits on tubes. When such treatments can be economically employed, they should be given careful consideration. Under conditions which will not permit of scale preventative measures, it is good practice to clean the tube surfaces periodically either mechanically or chemically or by a combined mechanical-chemical treatment. Any mechanical cleaning of tube surfaces requires reasonable care as well as the use of proper cleaning devices so that no scratching, scoring or other damage to the tubes results. Chemical cleaning methods should be of such a nature that no active corrosion of the tubes or other parts of the unit takes place; on the other hand, the chemical treatment must be drastic enough to dissolve the deposit of scale completely or loosen it sufficiently so that it can be entirely removed subsequently by a mechanical treatment. It is obvious that a chemical treatment which will only attack and dissolve part of the scale without affecting other scaled areas may be detrimental instead of beneficial to tube life.

SCOVILL OFFERS 3 SERVICES

Information which operators of condensers and heat exchangers can use to improve results is one of three types of service available from Scovill. From this *Service in Manuals* (of which "Scovill Tube News" provides a sample), our customers are given the benefit of our engineers' most recent thinking and the results of their studies.

Assistance is the second Scovill service. Through *Service in Men,* our engineers are available to you for specialized, individual consultation on problems relating to installation and maintenance of tubes.

And the third Scovill service is *Service in Metals* which makes available to you our complete laboratory facilities to help you determine the alloy best suited to your conditions.

Write for a free copy of our Condenser Tube Booklet, addressing Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn.

THIS IS NUMBER SIXTEEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY 91, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

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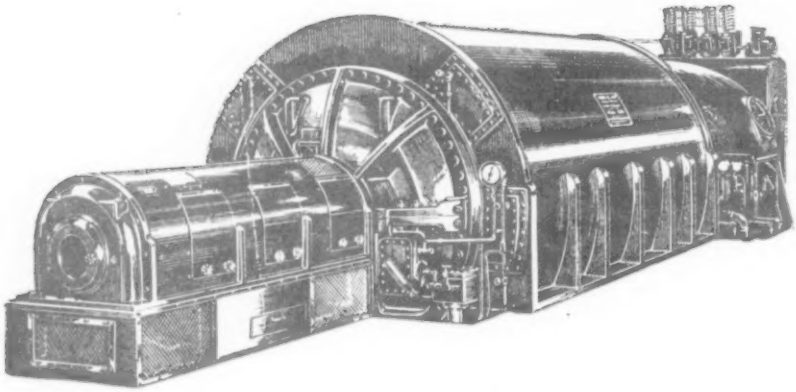
Today's Production Whirlwind *calls*



New TYCOL RIO TURBINE OILS...

Positive Protection for Your Turbines

Trouble-free, long-life turbine operation depends on the selection of a lubricant of known purity . . . service endurance . . . and high rust and oxidation inhibiting qualities.

Tycol's new RIO Turbine Oils provide that kind of lubrication. Repeated tests, in actual turbine units, showed original viscosity and acidity unchanged. Also, no time-wasting shut-down to clean out the oil reservoir was necessary. A little make-up oil and water removal was practically the only lubrication service demanded.

There are many other time- and money-saving advantages available to every turbine operator through these new Tycol RIO oils . . . one or more are certain to help you. Call in a Tide Water Associated engineer today. Ask him to explain the full benefits of Tycol RIO oils.

INDUSTRIAL TYCOL OILS-GREASES

TYCOL INDUSTRIAL

ENGINEERED FOR EVERY

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ENGINEERED LUBRICATION

Now more than ever before it is essential to use the best lubricants that can be obtained — for maximum production . . . top efficiency . . . lowest operating cost. That's why more and more operators are turning to Tycol scientifically engineered oils and greases.

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In developing this comprehensive line, Tycol subjects each individual oil and grease to rigid tests during manufacture. This control assures the required lubrication characteristics for maximum performance of that particular product.

Let us prove Tycol Engineered Lubrication efficiency to you . . . show you the extra value in every measure of Tycol oil and grease. Write your nearest Tide Water Associated office for the facts.

***SPECIFIC GRAVITY.** Clear, concise descriptions of the basic tests used to determine important lubrication properties — Carbon Residue, Pour Points, Specific Gravity and others — are given in Tide Water Associated "Lubricania". For your FREE copy write: Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

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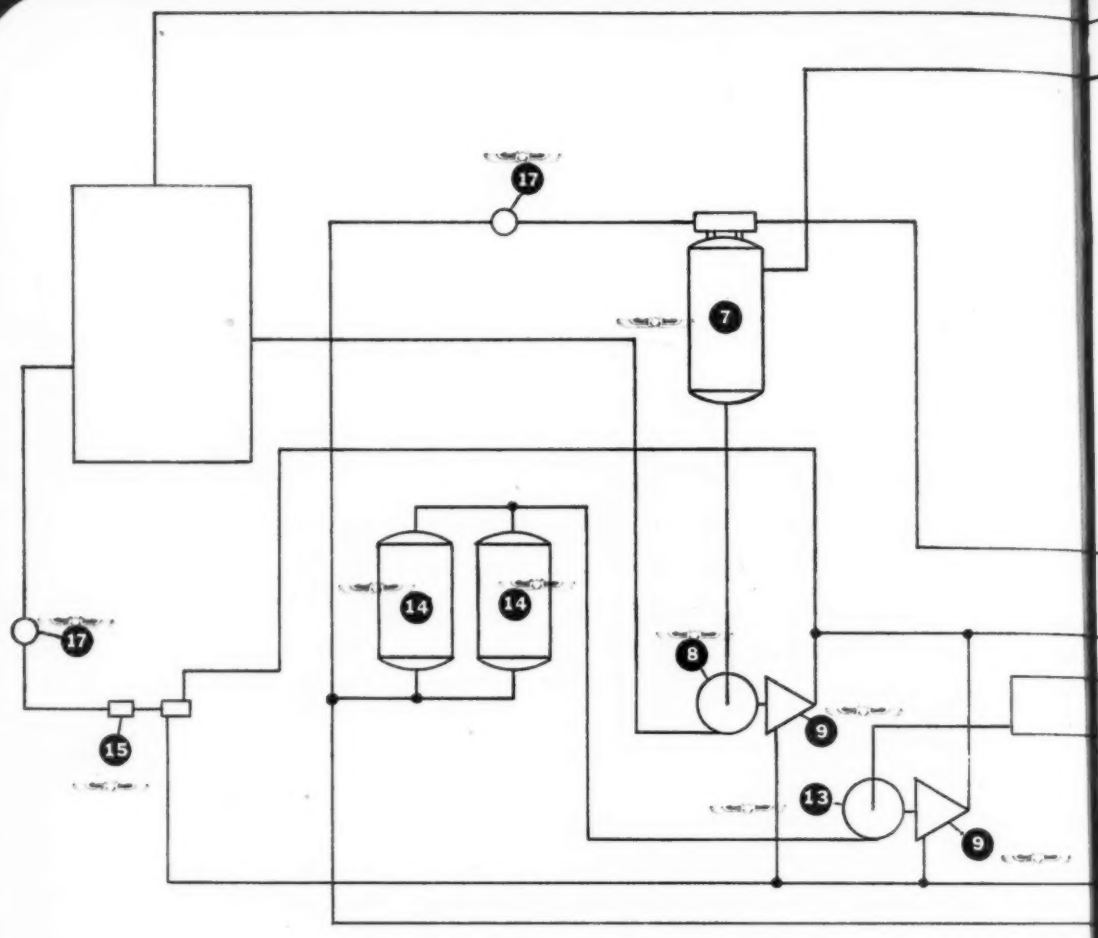
IT'S WORTHINGTON...



1 Extraction Turbine.
2 Generator & Exciter.
3 Switchgear.
4 Condenser.
5 Condensate Pump.
6 Steam Jet Air Ejector.
7 Deaerator.
8 Boiler Feed Pump.
9 Mechanical Drive Turbines.

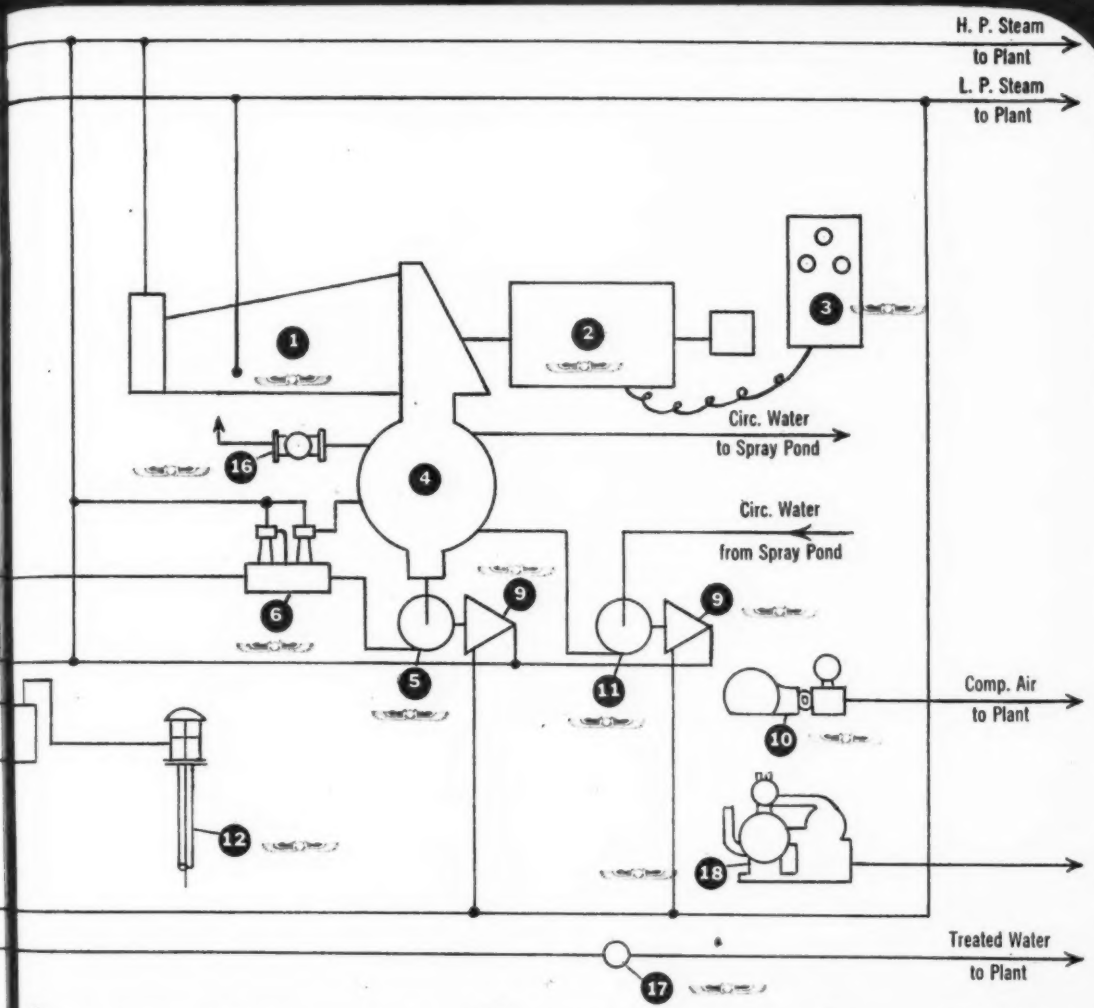
18 Major Items of Equipment for Steam Power Plants Are Products of Worthington

When planning equipment for steam power plants, the name Worthington becomes a logical consideration, because the Worthington line is the most complete . . . backed by engineering staffs that have been responsible for many of the important advancements in the handling of steam and water in power plants.

The flow sheet, representing a typical steam power plant of approximately 7500 kw. capacity, suggests the various items of equipment available under the Worthington trade-mark.

If you have known of Worthington through experience with any one of their products, you will be interested to learn about other types manufactured by the same company. Worthington engineers specializing in equipment for steam power stations are available in all parts of the world. Send the coupon today for information that may serve as the first step in experiencing why *there's more worth in Worthington.*

in Steam Power Plants



10 Compressor with Synchronous Motor.
11 Circulating Water Pump.
12 Deep Well Pump
13 General Service Pump.
14 Ion Exchange Softeners.
15 Fuel Oil Pumps.
16 Atmospheric Relief Valve.
17 Meters.
18 Air Conditioning and Refrigeration Equipment.

WORTHINGTON

FIRST IN STEAM POWER

WORTHINGTON PUMP & MACHINERY CORPORATION
Harrison, N. J.

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☐ *Check here to have a Worthington representative call.*

NO WEAK SPOTS

INSPECTED
INSIDE AND OUT

Republic **ELECTRUNITE** Boiler, Condenser and Heat Exchanger Tubes are made from highest quality flat-rolled steel, *both sides of which are open to close visual inspection.* Thus, the surface which becomes the inside wall when formed into tubing is free from hidden defects.

IN REPUBLIC ELECTRUNITE BOILER TUBES

When ordering new boilers . . . when retubing existing equipment . . . specify Republic ELECTRUNITE Boiler Tubes. Then put them in operation with confidence—because there are no weak spots in these modern tubes. They are equally strong at every point in their structure.

Why? Here are the reasons—

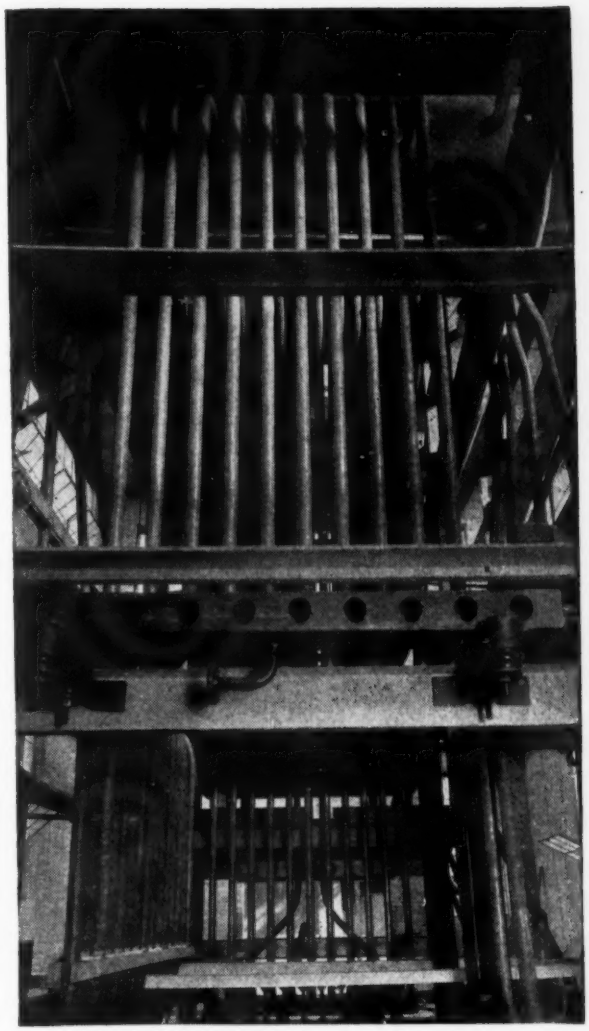
First: Republic ELECTRUNITE Boiler Tubes are made from highest quality flat-rolled steel. When formed into tubular shape, wall thickness is *absolutely* UNIFORM—throughout every length.

Second: The *improved* Republic method of electrically welding the tubing is so efficient that the weld area is 100% as strong as any other point in the wall. Thousands of tests, together with hundreds of installation service records of more than 150,000,000 feet of ELECTRUNITE Pressure Tubing in all types of steam generating and heat transfer equipment, conclusively prove that statement.

And Third: Because Republic ELECTRUNITE Boiler Tubes are scale-free, there is less danger of localized corrosion causing premature tube failure and costly service interruptions.

Before you again order new boilers or retube present equipment, it will be to your advantage, safety and profit to thoroughly investigate Republic ELECTRUNITE Boiler Tubes.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York



• Every ELECTRUNITE Boiler Tube must pass a rigid testing routine before leaving the factory —your assurance of dependability and long life in installations such as the one shown above.

Republic
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

TESTED IN WAR

FOUR STARS
ON OUR E PENNANT
TESTIFY TO SARCO
PERFORMANCE
IN THE WAR EFFORT

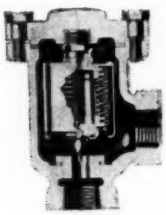
Three important facts will emerge from the war effort—thrice recognized by the Army and Navy E:

1. **Both the capacity and accuracy of Sarco production have been increased by new methods and equipment.**

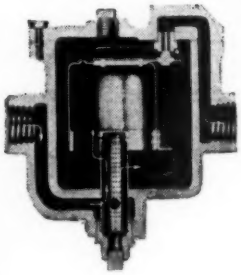
2. **In the interim of four years, new developments that were in the making have been pushed ahead. New Sarco traps and controls are now available.**

3. **The urge for mass production of war material with high accuracy and speed has brought about new applications of Sarco products. The result: modernization of your steam and hot water facilities can set your plant ahead by about ten years!**

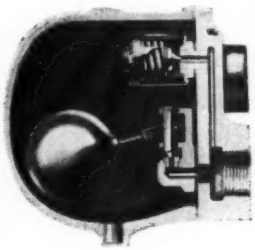
A few reminders of Sarco Service are illustrated on these pages. Let's look at a few of the developments that will improve your product, speed your production and lower your fuel and metered water costs. Ask for the Sarco Hook-Up Book.



The New Sarco No 9 Thermostatic Steam Trap with high efficiency and capacities. Bulletin No 250.



Sarco Bucket Steam Trap—for pressures up to 900 lbs Bulletin No 350



Sarco Float-Thermostatic Steam Trap Three ranges —up to 2" and 200 pounds. Bulletin No 450

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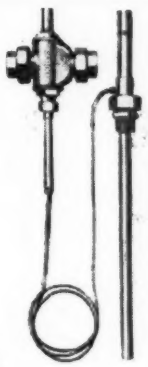
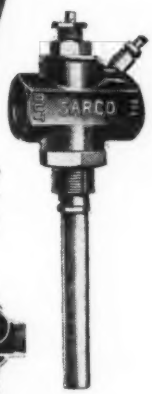
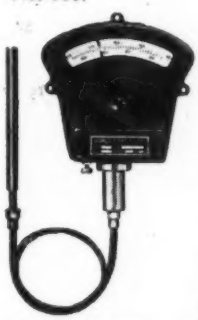


Sarco TR-21 Temperature Regulator for accurate, reliable control of hot water and process work. Bulletin No 600.



Sarco TR-40 — Low cost Cooling Control for compressors, stills, degreasers, etc. Bulletin No 700

Sarco Water Blenders for showers, Diesels, brine and process work Bulletin No. 800.



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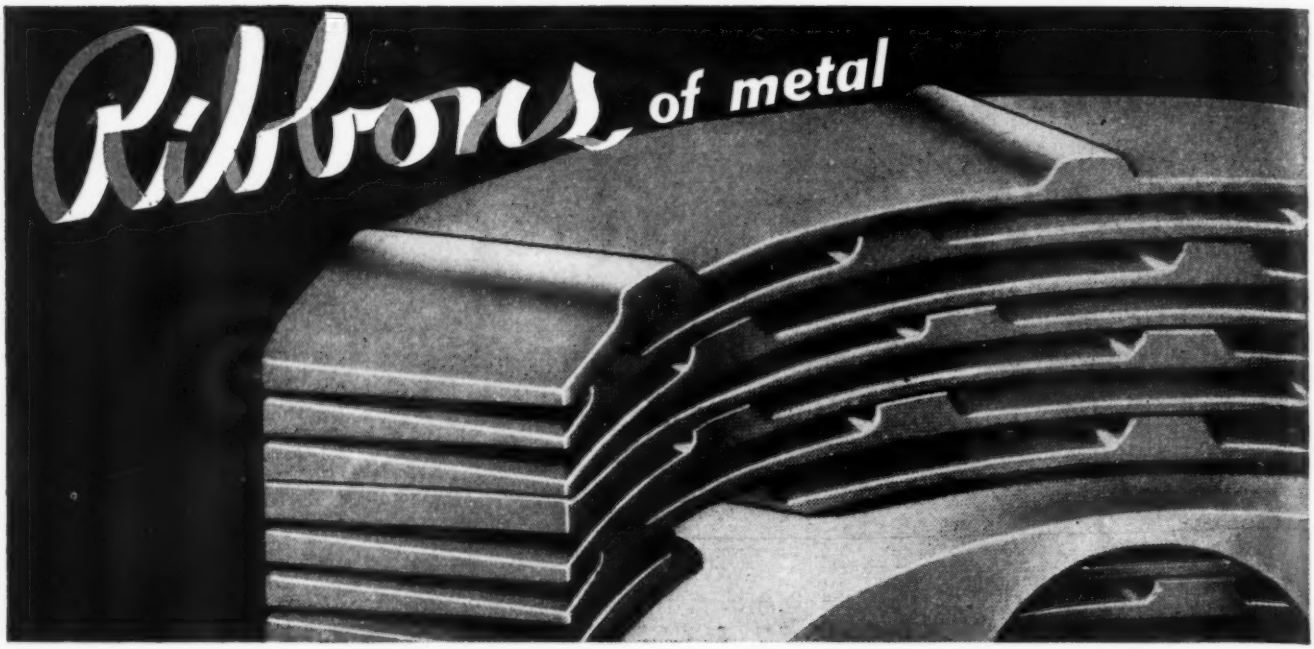
Sarco TR-40 Cooling Control is saving up to 50% of metered water on degreasers, stills, compressors, condensers and other cooling processes.

Sarco Blenders, now available in three types, are saving heat, hot water and tempers, on showers, Diesel engine jackets, brine coolers and process work.

Sarco Electric Controls have proven high accuracy on chrome plating, chemical stills, and food curing. Ask the nearest Sarco representative.

Saves Steam

• Sarco Canada, Ltd., 85 Richmond St., W., Toronto 1, Ont.



..that entrap particles and separate liquids!

Not woven wire cloth...not fabric... but *ribbons of metal*...do the filtering in an element developed by Purolator.

The principle is entirely new. The enlarged section (above) shows its construction.

A metallic ribbon is wound edgewise on a cylindrical perforated frame. At regular intervals, supporting projections occur. Their height determines the degree of filtration. Elements can be made with filtering gaps as small as 0.0005"; as large as 0.025".

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It had to be hard—so that edges of the thin ribbons would neither burr nor wear under the abrasion of a doctor blade with which some models are equipped to remove accumulated sludge.

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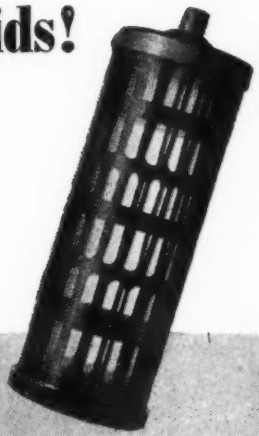

MONEL ELEMENTS INSURE EFFICIENT FILTRATION FOR POWER SYSTEMS

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*Reg. U. S. Pat. Off.

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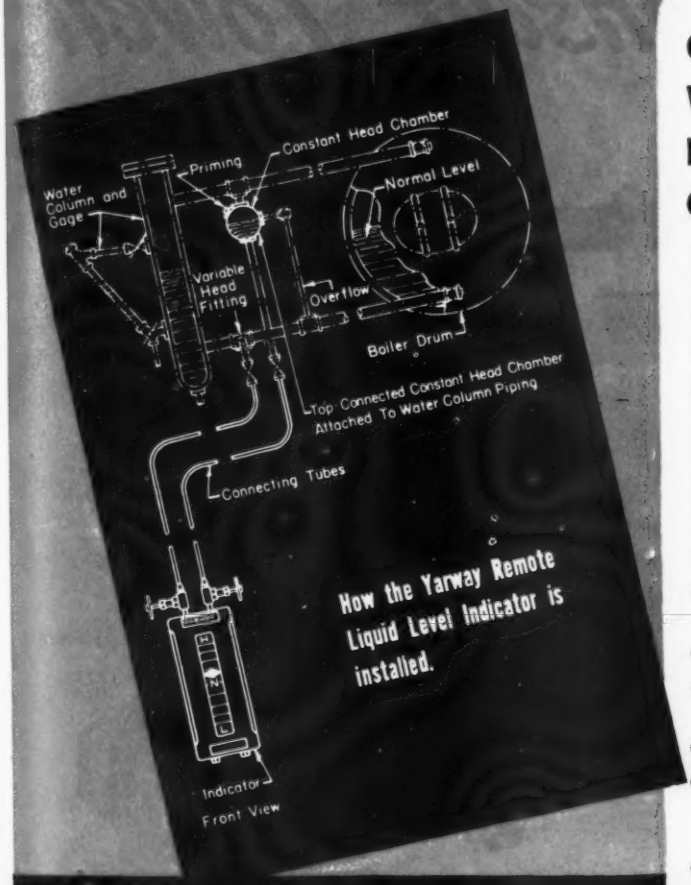

How the Yarway Remote Liquid Level Indicator is installed.

CONSTANT, ACCURATE BOILER WATER LEVEL INDICATION ON INSTRUMENT PANEL OR OTHER CONVENIENT EYE LEVEL LOCATION

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- No glass under pressure.
- No packing or stuffing boxes . . . practically frictionless.
- No oiling or adjustment required.
- Luminous pointer and dial letters "H" and "L" insure clear readings even in total darkness.
- Shows water level beyond range of conventional overhead gage glass and always indicates "High" or "Low"—even when full or empty gages look the same.
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YARWAY REMOTE LIQUID LEVEL INDICATOR

FOR ASSURED VALVE

consult Powell

Fig. 6031 WE—Class 600-pound Cast Steel Globe Valve, with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 256—Iron Body Bronze Mounted Globe Valve for 250 pounds W.S.P. Has flanged ends, outside screw rising stem, bolted flanged yoke, and regrindable, renewable bronze seat and disc.

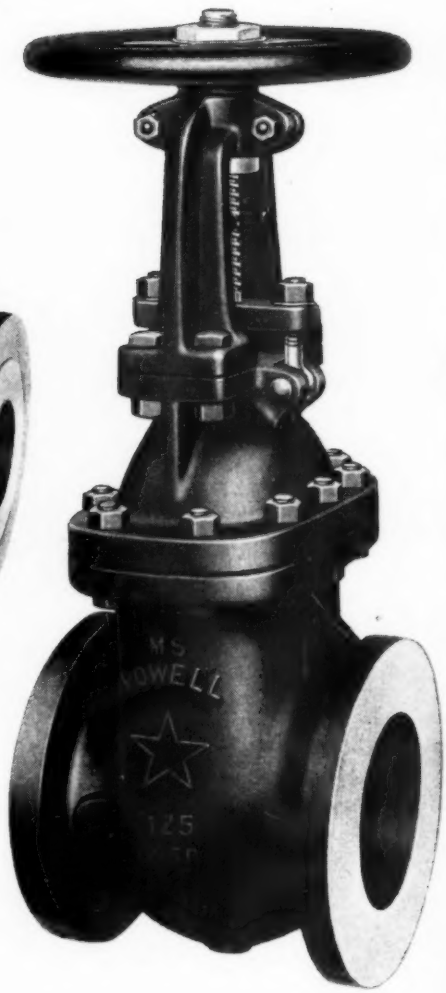

Fig. 1793—Iron Body Bronze Mounted Gate Valve for 125 pounds W.S.P. Has flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Also available with taper wedge double disc—Fig. 1444.

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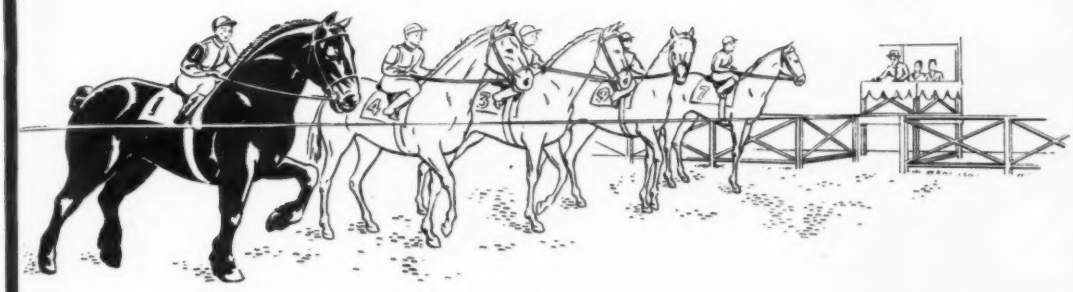
PERFORMANCE

Engineering first



LET'S BE SURE THE EQUIPMENT FITS THE JOB!

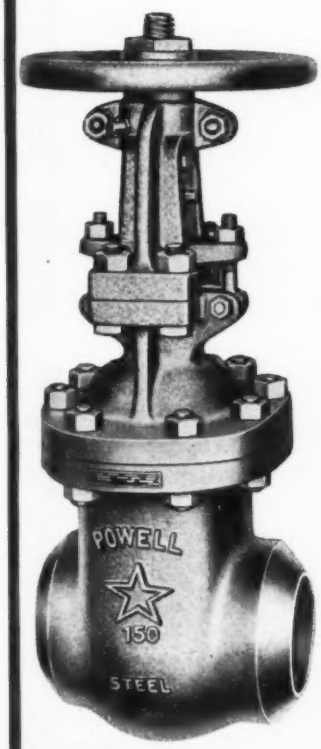


Fig. 1503 **WE**—Class 150-pound Cast Steel Gate Valve, with welding ends, outside screw rising stem, bolted flanged yoke and taper solid wedge.

Everyone knows it would be silly to enter a Draught Horse in a race. On the other hand, a Thoroughbred wouldn't last long pulling a heavy load.

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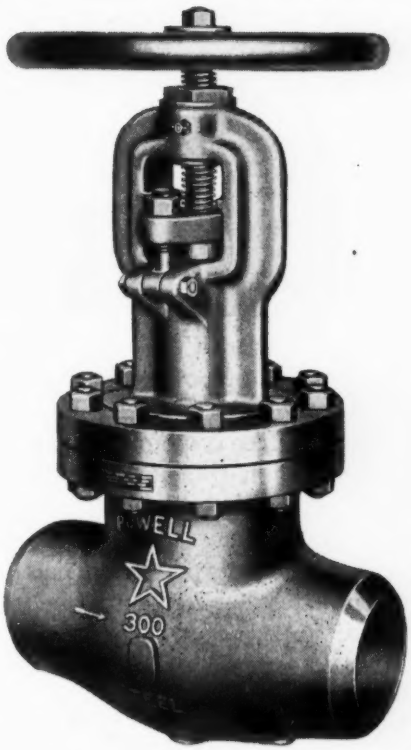
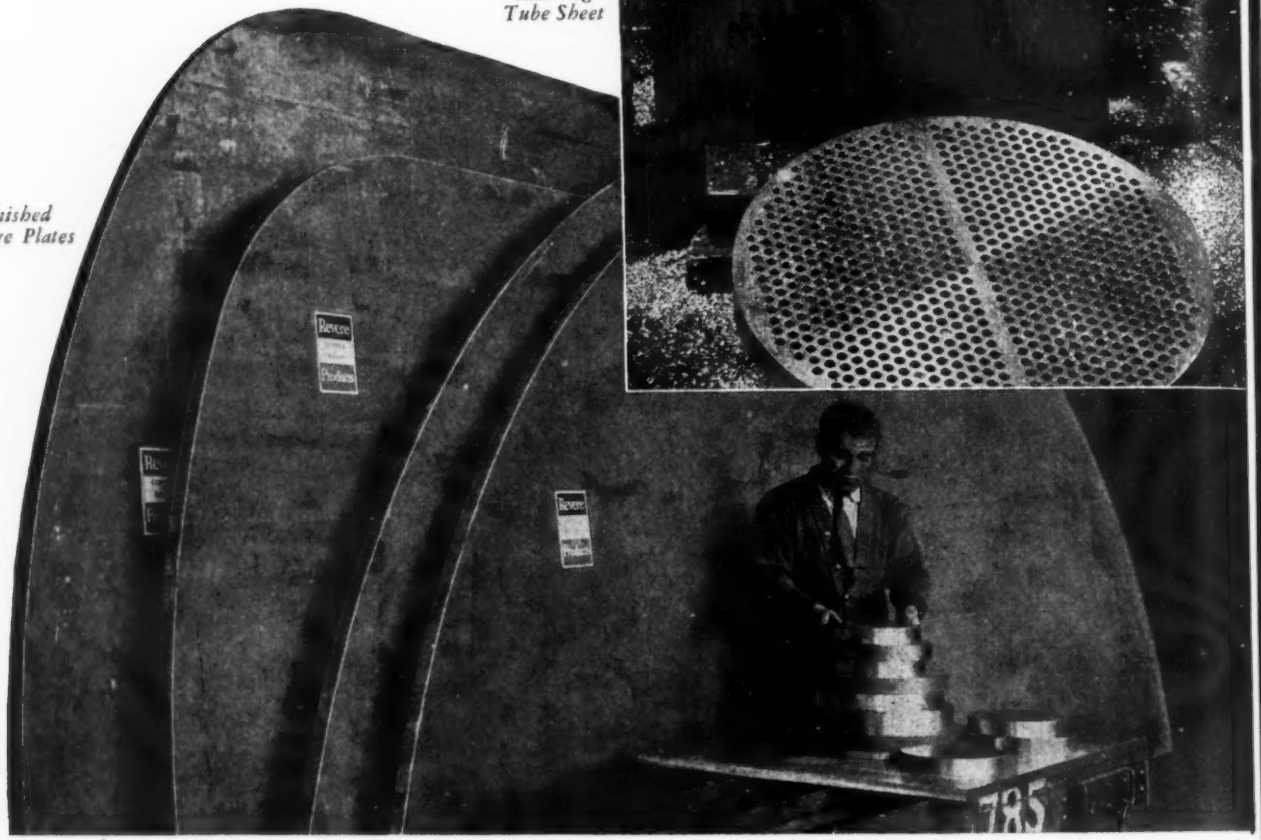


Fig. 3031 **WE**—Class 300-pound Cast Steel Globe Valve, with welding ends, outside screw rising stem and bolted flanged yoke.

VALVES

Condenser Tube Plates by REVERE

Reaming Tube Sheet



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JUST as Revere Condenser Tubes are preferred in thousands of power plants because of their long, satisfactory service, so are Revere Plates. The two make a perfect combination, both being made with the same high skill, to the same standards. Revere Plates are produced by hot-rolling "cakes" after machining the original casting for a perfect surface.

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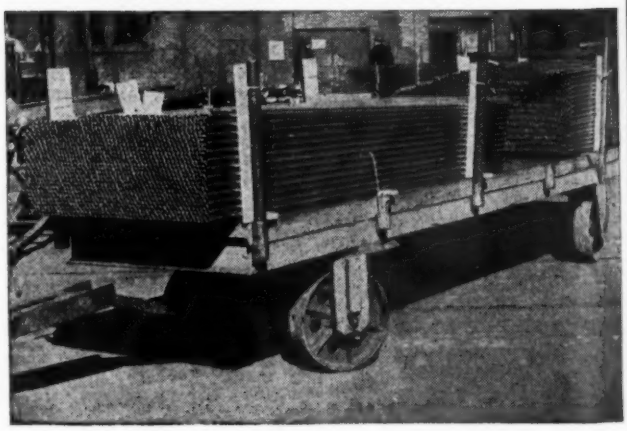
Listen to The Human Adventure *on the Mutual Network every Wednesday evening, 10 to 10:30 p. m., EWT*

Below: Condenser Tubes in Revere Plant



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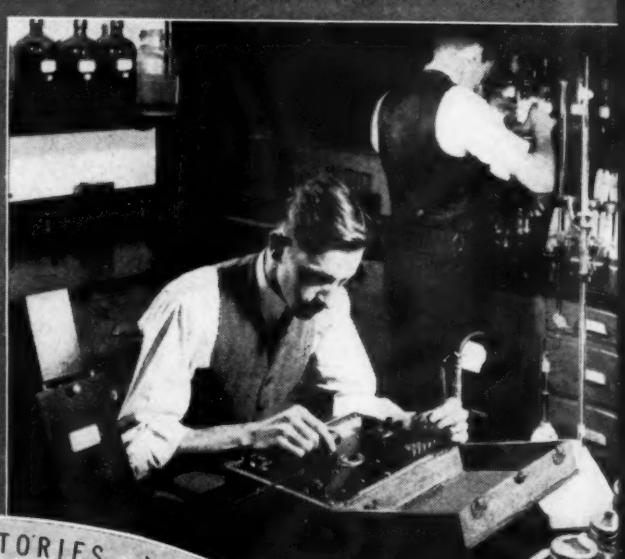

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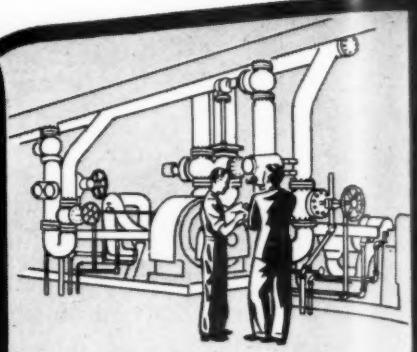

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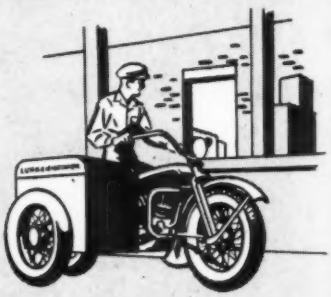

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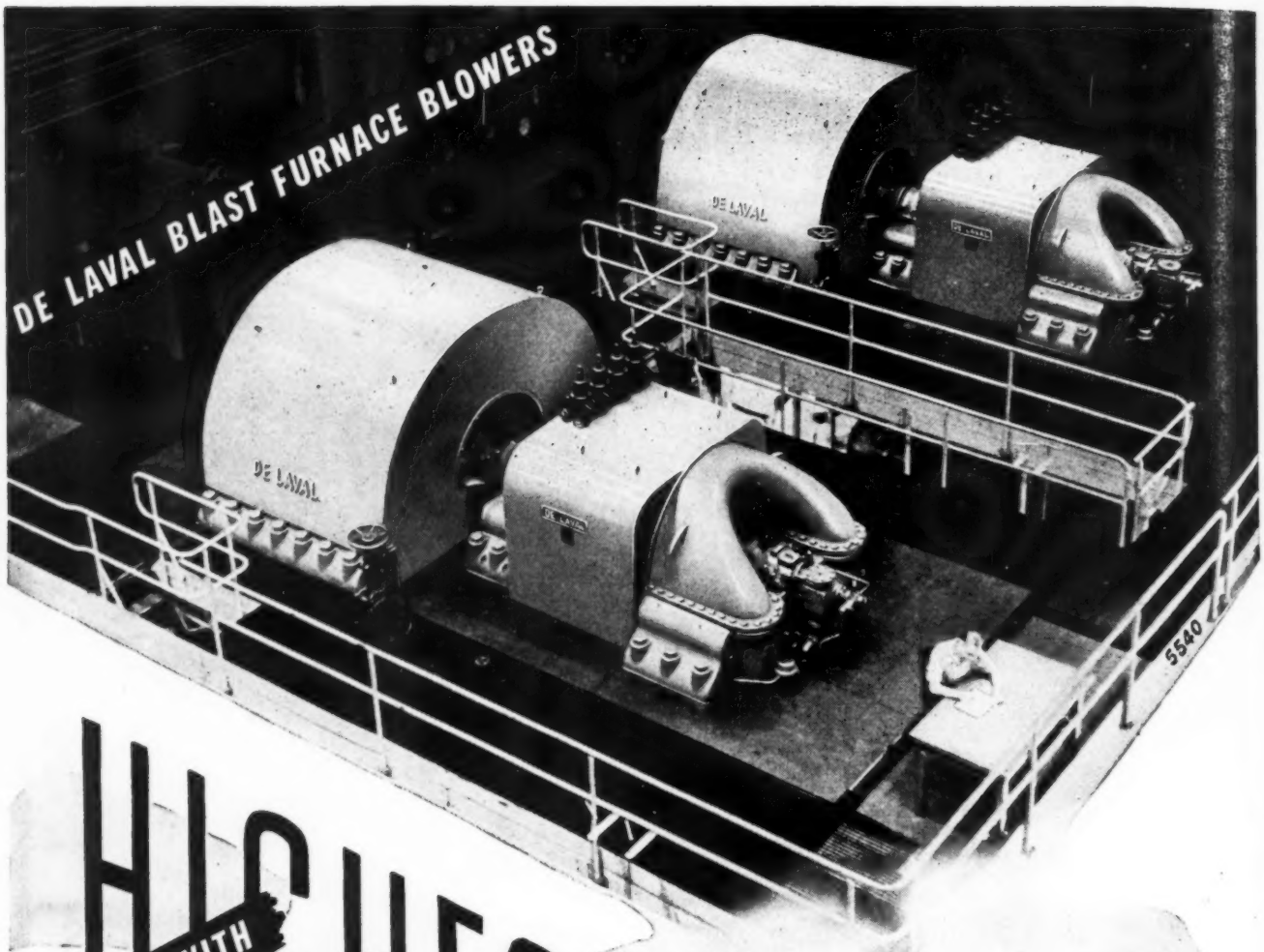

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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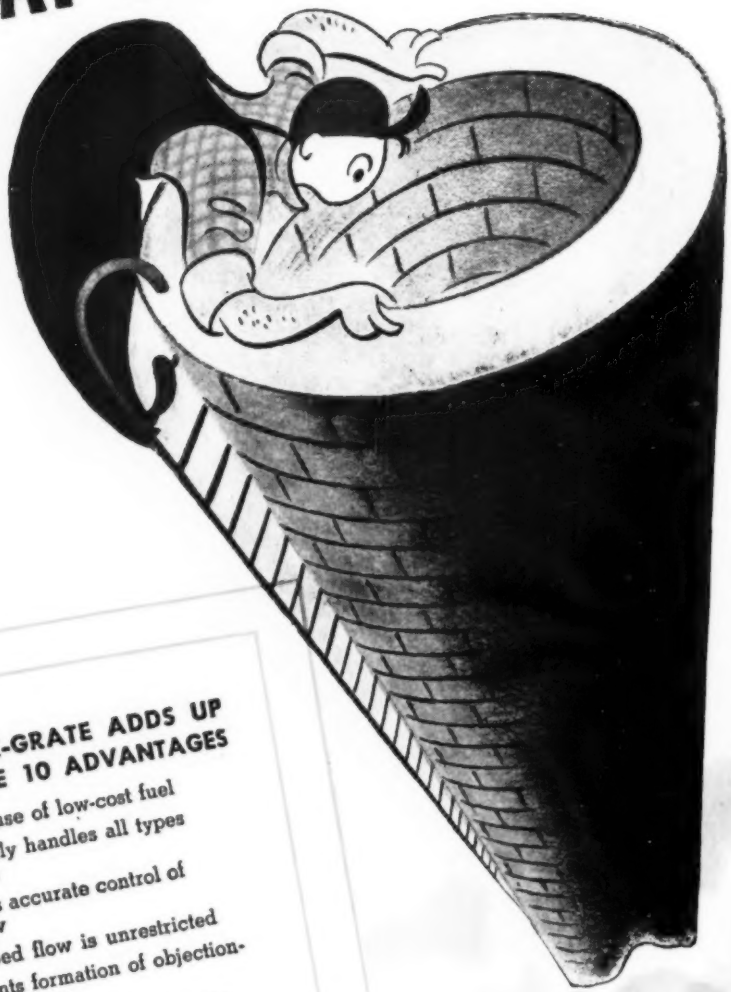

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LINK-GRATE STOKERS

why GIVE MORE STEAM PER POUND OF COAL

You'll never see rolling black smoke belching from the stack of a properly operated Westinghouse Link-Grate Stoker. And that's a sure sign of thorough combustion—that power dollars are not going up in smoke. With a Link-Grate you'll get more steam per pound of coal—and three cheers from the Smoke Inspector and citizens for helping to eliminate the smoke nuisance.

The Link-Grate motion maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. Agitation at the rear of the stoker promotes a uniform flow of coal over the underfeed section and keeps the burning lanes open.

Grates first move up to break open the fuel bed and let low pressure air flow through the gates. The downward movement of the grates crumbles and conveys the burning fuel.

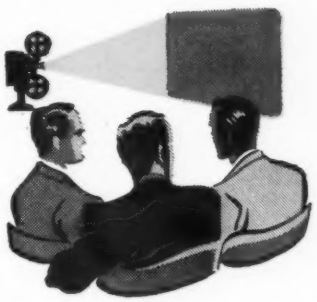
Positive movement of the fuel bed toward the continuous ash discharge eliminates periodic dumping and reduces labor. Clinkers are no problem. Link-Grate motion prevents closed pores in the fuel bed and eliminates the cause of large clinkers.

So, before you make another investment in stokers, be sure you have complete information about the Link-Grate. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a present user. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-50464

SEE A LINK-GRATE DEMONSTRATION IN YOUR OWN OFFICE

Almost invariably, when a stoker buyer sees a Link-Grate in action he becomes a user. Realizing the difficulty that is often encountered by an individual or group in visiting a stoker installation, Westinghouse has prepared a new 15-minute, 16-mm sound movie, showing in detail the operation of a Link-Grate Stoker. Prints of this picture are available on loan for your private showing. Just address your request to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.



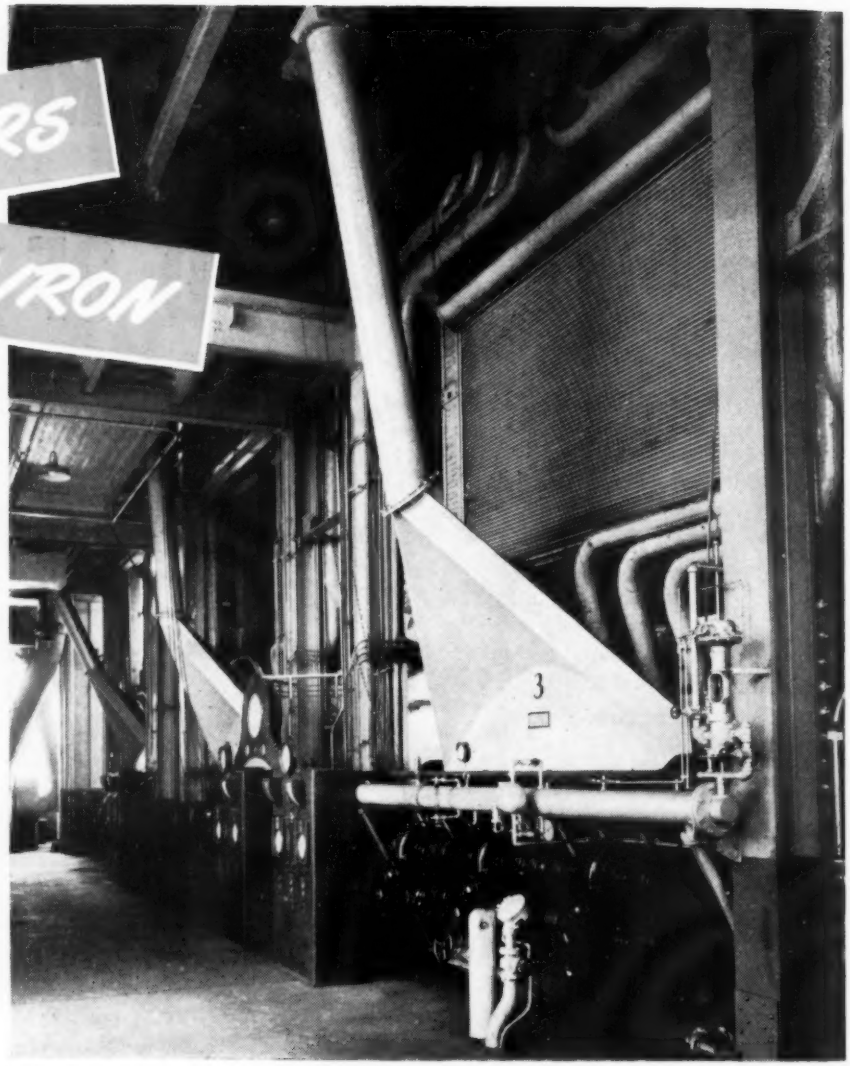
WESTINGHOUSE

Link-Grate STOKERS

WHERE THERE'S COAL THERE'S CORROSION

so these chutes are

BYERS WROUGHT IRON



When it comes to building or repairing equipment, the engineers' job is only half done when he designs for structural strength. He must design for *wear* as well. This is of extra importance in coal handling equipment, where sulfur compounds in the fuel may be leached out by moisture, and form aggressive, destructive acids.

When the new coal chutes illustrated were built at the American Viscose Corporation Plant at Parkersburg, West Virginia, the engineers gave proper weight to the wear factor, and selected materials accordingly. Byers Wrought Iron Pipe, 16-inches in diameter, was used to convey the coal from overhead bins to the stokers. A 26-inch pipe, fabricated from Byers Wrought Iron ¼-inch plates, carries pulverized coal from railroad cars.

Conditions under which coal chutes operate and the character of the coal conveyed, vary so widely that no one can say exactly how long any individual installation will last. But the experience of users who have made comparative tests very definitely indicates that under any given situation, wrought iron can be expected to last longer, and to cost less per year of service. The extra cost of wrought iron is generally only a small percent of the total investment. After this is written off by a short period of extra life, each additional month and year on the job pays a definite dividend.

In one installation where very careful records were kept, wrought iron lasted twice as long, and handled over three times as many tons of coal, as the low-first cost material previously used.

The reason for wrought iron's unusual service is found in its unusual structure. Tiny fibers of glass-like silicate slag—250,000 or more to the square inch of section—are threaded through a main body of high-purity iron. These fibers act like baffles, in halting and dispersing corrosive attack, and so discourage pitting and rapid penetration.

Our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment" illustrates and describes a number of installations. Let us send you a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

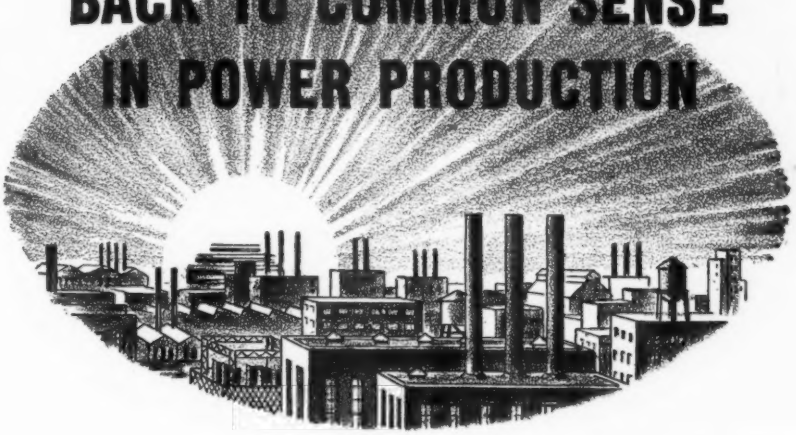
CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • OCTOBER 1945 • ESTABLISHED IN 1882

BACK TO COMMON SENSE IN POWER PRODUCTION



THE WAR IS OVER. Every man must now turn back to the ways of peace. And that holds for power engineers, because many wartime power habits no longer make sense.

In war nothing much counted but production and time schedules. High cost, danger, smoke, dirt, inconvenience, bad working conditions, baling-wire repairs, overworked crew and equipment were mere incidents. Once more we must see them as the deadly enemies of business success and personal advancement. A complete about-face is essential.

As a starter consider dirt, dust and smoke. They were tolerated to win a war, but what sane engineer today would build a plant to spew refuse over the countryside, win ill will, create lawsuits and ultimately force costly makeshift alterations. From now on this nuisance angle must be considered in every power-plant change or improvement, however small.

In recent years many wise words have been written about fuel flexibility—selecting boilers, firing equipment, and fuel and ash handling adequate for any fuel that might become economical. Just to save a few investment pennies, don't get stuck with a skimpy plant requiring premium fuels.

If there's any handfiring left in your plant, toss it out—also any manual handling of coal or ash. They simply don't jibe with American wage scales.

Leak chasing should be an early assignment—spotting all the little wastes of steam, water and compressed air. And don't overlook the big waste in every industrial plant that dumps exhaust steam to atmosphere or even to condenser. Figure whether higher boiler pressure would pay out in reduced exhaust loss.

Several leading manufacturers stand ready to tell power men about modern factory electrical-distribution systems. Right now, with reconversion under way, this matter is critically important. Don't extend obsolete systems; better start new. Use load centers where practicable. Provide flexibility for future power applications. Eliminate distribution wastes and hazards.

If present boiler pressure is too low, watch out when a new boiler, engine or turbine is planned. Shall the original error be extended? Would a complete shift to a new pressure be worth while? Or, perhaps, will it be best to install higher-pressure units and run them temporarily at the lower pressure?

Ample metering and control equipment should be a part of every plant extension or modernization. Meter power-service consumption.

In all installations of equipment, piping, ducts, etc, allow enough elbow room for repair and maintenance crews.

Reorganize your manpower for efficient operation. You won't be able to get men cheap anyway, so pay a little more than the market price; then demand brains instead of brawn. Encourage ambition and study, particularly of electronics and other new developments. Assign responsibility and demand results.

These are examples of right thinking for peacetime power plants.

Florida Power Operates New

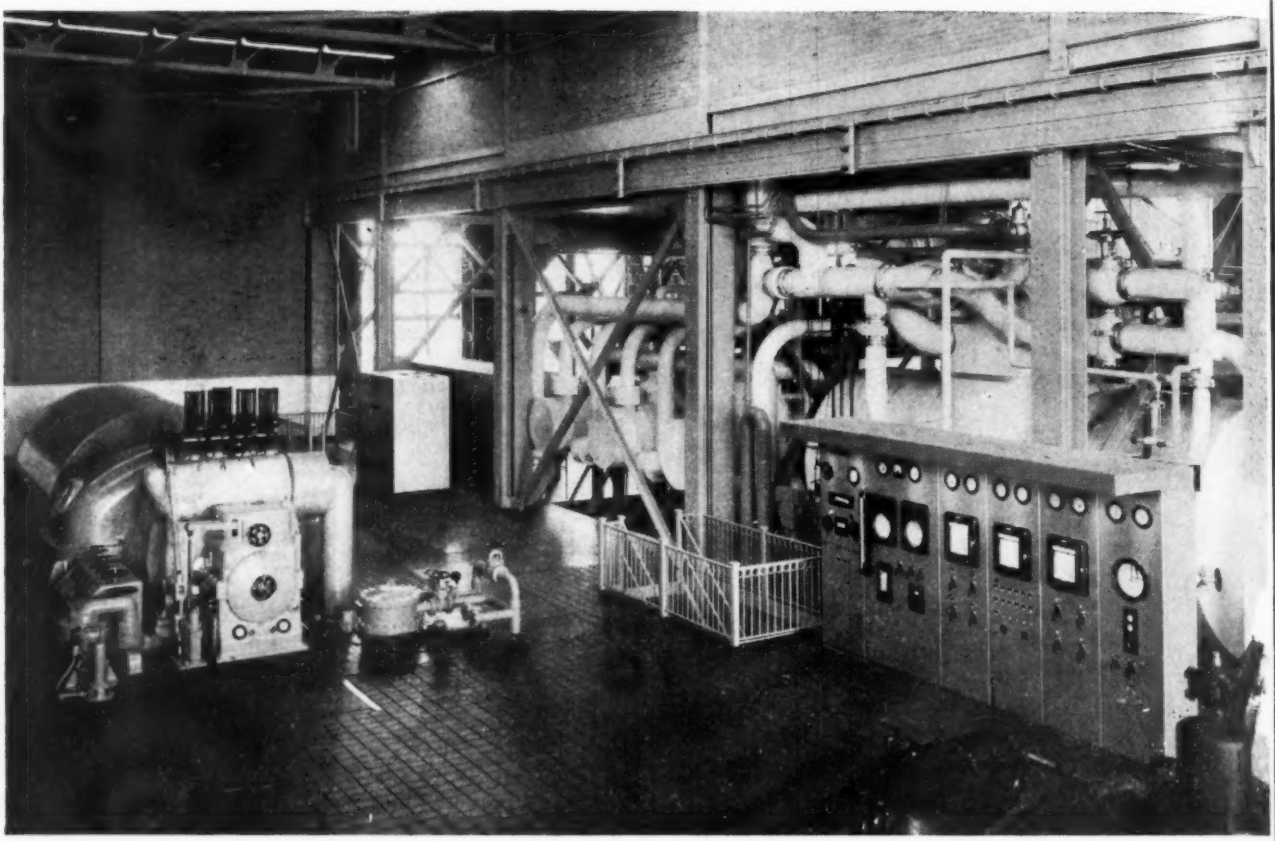


Fig. 1—25,000-kw 850-psia 900-F turbine-generator, St. Petersburg Bayboro plant, Florida Power Corp. Feedwater-heating equipment is in background beyond the operating control panels

New base-load turbine-generator, 850 psia and 900 F, notably increases system's installed capacity. Wartime procurement difficulties influenced design. Electrically driven auxiliaries and 4-point-bleed feedwater heating are the principal features of the new steam-plant extension design layout

By PAUL L BARTOW
Superintendent of Construction
Florida Power Corporation

▶ BEFORE THE WAR, the Florida Power Corp made plans for an addition to the Bayboro plant, at St. Petersburg, Fla., to provide 25,000-kw capacity that would soon be needed. But before the boilers were completed, orders from the War Production Board halted further construction. In 1943, because of a critical power situation in Florida, WPB granted a priority to finish the installation. The test run was started early this year.

Bayboro is the base-load plant despite the long transmission distance to the northern tip of the state and to the Georgia Power and Light Co which is a wholly owned subsidiary of Florida Power. Other plants are located at Inglis, Avon Park and Benson Springs, Fla. There are three small hydro plants having a total capacity of about 10,000 kw and the steam-station capacity is 58,500 kw, without the new addition.

The four major steam stations were built between 1924 and 1926, near the end of the Florida boom. Steam conditions at Inglis and for the initial installation at Bayboro are 300 psi, 625 F; and at Benson Springs and Avon Park, 400 psi and 700 F.

For quite a number of years there was excess capacity as a result of overbuilding during the Florida boom. In 1935, the small rate of load increase accelerated and, at the beginning of 1940, the need of additional capacity became apparent.

Studies, to determine the proper location of the new capacity, showed St. Petersburg to be the most favorable. The Pinellas Peninsula, on which the city is built, is only a small part of the area served by the system. Yet owing to the city's size and the concentration of population in the county, a considerable portion of the additional capacity requirement is in this area. Also, the St. Petersburg plant is on tidewater and enjoys the lowest fuel cost of the four steam plants.

With one exception, a 6000-kw unit, all existing units were of 12,500 to 15,000-kw capacity. Rate of load growth indicated that it was necessary to go to a large-sized unit. To effect the lowest production cost consistent with conservative design it was determined to

25,000-Kw Unit at Bayboro Plant

use a higher pressure and temperature. Finally, a 25,000-kw unit was installed in the St. Petersburg plant, to operate at 850 psi and 900 F. At the time of this selection, only a few stations were operating with similar conditions, and there was some feeling that the decision should have been more conservative. However, within a few months neighboring systems in Florida and Georgia announced new installations with these same conditions. They seem now to have become standard for this size unit.

For a number of years all steam power plants in Florida have burned Bunker C fuel oil, readily obtained from refineries on the Gulf Coast. Coal is costly, owing to transportation distances. Oil obtained at the Port Tampa, Fla., terminal is delivered to both the St. Petersburg and Inglis plants by a fleet of company-operated barges and tugs. A 55,000-bbl storage tank, to supply the St. Petersburg plant, and a reserve storage tank of 80,000 bbl. at Port Tampa, enables the company to purchase fuel oil in tanker lots.

Owing to a boiler-capacity shortage at St. Petersburg and uncertain business conditions, it was decided to install new boiler capacity first, and to postpone the turbine installation until need for it was evidenced further. Therefore the new boiler capacity would operate initially at 300 psi and 600 F. Accordingly, two integral-furnace boilers, each rated 175,000 lb per hr, 860 psi and 910 F, were installed to operate at 135,000 lb per hr maximum under the low-pressure conditions.

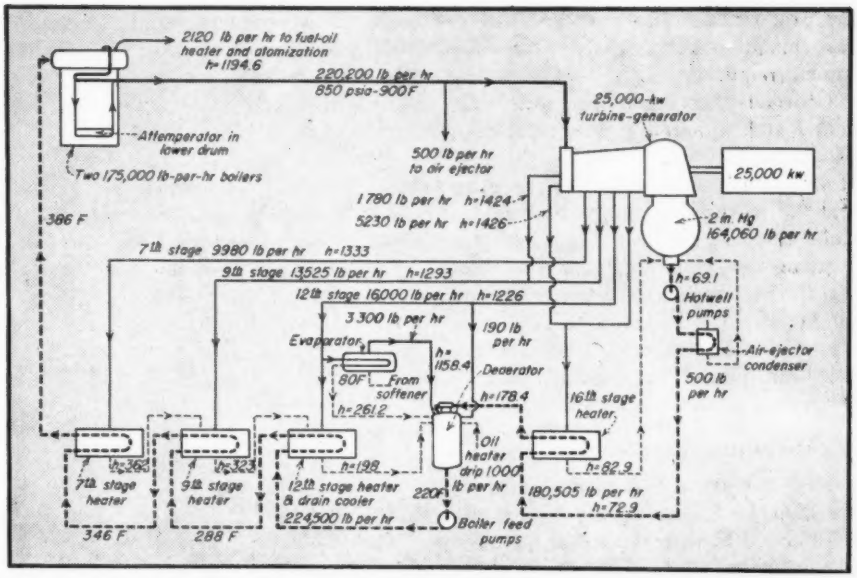


Fig. 2—Heat balance diagram of new turbine-generator at 25,000-kw load, 850 psia and 900 F steam conditions and 2-in.-Hg backpressure with makeup equal to 1½% of feedwater. Deaerator steam supply is principally from evaporator output, supplemented by bleed steam from the 12th turbine stage as needed

These boilers are 2-drum design with Bailey stud tubes in the side walls and furnace roof, and bare tubes backed with refractory brick for front and rear walls. Floor tubes are covered with a layer of firebrick topped with ganister. In the first pass are two rows of screen tubes and the convection superheater arranged for three steam passes, with an attemperator type of superheat control. A portion of the steam is taken out between the second and third steam passes to the attemperator tube nest in the lower drum. A valve in the steam connections automatically controls the flow, and hence the steam temperature. Tubular air heaters raise the combustion air temperature to 520 F.

This steam-generator arrangement, without economizer, has a guaranteed efficiency of over 85%, which has been materially exceeded in operation. Each boiler has one forced-draft and one induced-draft fan, provided with vane controls and driven by induction motors. Four steam-atomizing oil burners fire each boiler.

Complete automatic combustion and feedwater-control equipment was installed, the instruments being located on a control panel in front of the boilers. Here, also, are the control switches for the boiler feed pumps, air compressors, motor-operated valves, etc.

Total steam capacity is not needed for the new unit and the extra capacity is, therefore, made available to the low-pressure turbines through a reducing valve and desuperheater. Because of size limitation of these boilers and to give somewhat greater continuity of service as compared to a single large unit, two boilers, instead of one, were placed in service in July, 1941. In the meantime, system load had grown sufficiently to warrant installation of the

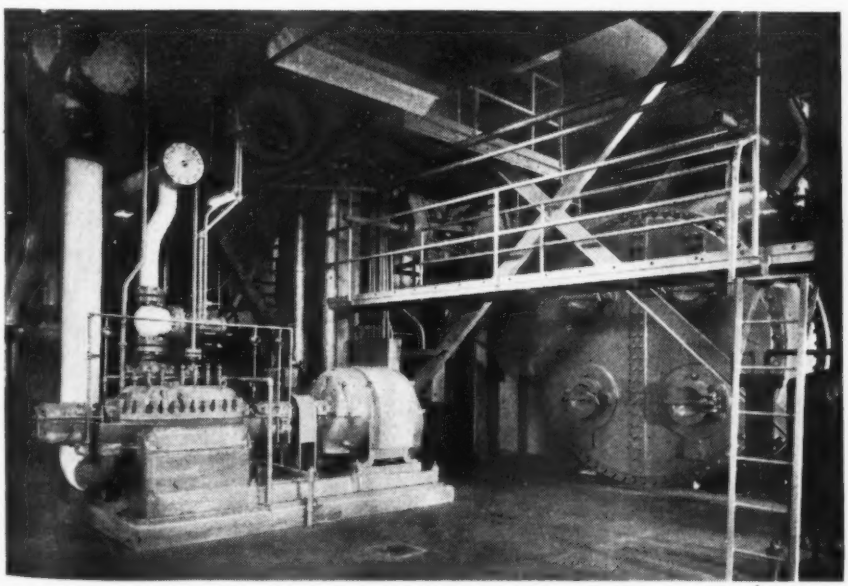


Fig. 3—Electrically driven boiler feed pumps and outlet end of the sectionalized single-pass 23,000-sq-ft surface condenser of the new turbine-generator unit

turbine unit, and a preference rating was accordingly obtained from WPB in January, 1942. Contracts were let for the principal equipment, and designs were being prepared when, in August, 1942, the preference rating was cancelled to save manufacturing capacity for more urgent requirements.

Contracts for equipment were cancelled and, apparently, the installation was to be deferred until after the war. However, the load continued to grow and the power situation in Florida became critical. In June, 1943, both the company and the WPB made studies, and the preference rating was reinstated in August, 1943. Actual construction was started December 1, 1943, and the new unit placed in operation during December, 1944.

Turbine-Generator Features

The 25,000-kw turbine-generator is designed for steam conditions of 835 psi and 900 F, with extraction for feedwater heating at four points, the 7th, 9th, 12th and 16th stages. The unit has a hydrogen-cooled generator with a capacity of 31,250 kva at unity power factor and 0.5-psi hydrogen pressure; with 15-psi hydrogen pressure, capacity is 15% greater. The turbine has a capacity of 31,250 kw at 27-in.-Hg vacuum. The exhaust hood of the turbine is fitted with an explosion diaphragm and low-vacuum trip. The unit has a turning gear, and the direct-connected exciter is of the room-ventilated type with an air filter. It operates at 3600 rpm.

Company engineers made extensive studies in determining condenser and cooling-water-system specifications to effect maximum operating and maintenance economy and to prevent condenser-tube troubles, which they had experienced for some time. During the past few years, sea water from Tampa Bay and the Harbor had apparently changed in character, and Admiralty metal tubes no longer gave satisfactory life. Also, trouble had always been experienced with oyster shells and barnacles.

A divided water box was considered mandatory for continuous operation, and tests made in an older condenser indicated that aluminum brass was the proper tube alloy for the water conditions. The tube sheets are of Muntz metal. An unlimited cooling-water supply and site restrictions made a single-pass condenser desirable.

Much thought was given the cooling-water velocity; in the light of our own and other plants' experience, it was felt that the design velocity should be 6 ft per second although most recent designs have used somewhat higher values. Accordingly, a single-pass condenser, with 23,000 sq ft of ⅞-in.-OD tubes having an effective length of 24 ft, and welded-steel shell, spring supported, was purchased and installed.

An interesting question was raised on the choice of one or two circulating pumps. Two half-capacity pumps were desired to provide continuity of operation, and considerable discussion arose about the amount of critical materials that could be saved by installing a single full-capacity pump. Studies disclosed that no practical difference existed in either the amount of materials or the cost between one large and two small circulating pumps for the sizes considered.

Owing to past operating troubles with oyster shells and barnacles a new intake well was installed to serve only the new unit. The well is divided into two sections, each with a traveling screen and vertical circulating pump. Stop logs make the division into sections so that it is possible to unwater one complete half of the intake well including pump and screen, or to unwater either of the screens for repairs, with all of the water passing through the other. In this manner, the intake well can be cleaned out, one half at a time, without removing the turbine from service.

The existing-plant condenser cooling water is discharged to the harbor through a concrete tunnel 800 ft in length, to prevent recirculation. A new tunnel paralleling the existing one was needed for additional capacity, and it was made sufficiently large to handle the cooling water for two units. It is likely that only one more unit will be installed in the future; the plant location being close to downtown St. Petersburg, further expansion will require a new station at another location.

H-P Steam Reducing Station

To use the extra high-pressure boiler capacity in the low-pressure system at 300 psig and 600 F, a reducing and desuperheating station was installed, with 125,000-lb-per-hr capacity. This is equivalent to the two smaller existing low-pressure boilers. An alarm which signals the operator when the temperature reaches 625 F, shuts off the high-pressure steam at 650 F. Recirculation of boiler salines to maintain a high pH in the feedwater made a desuperheater supply pump necessary.

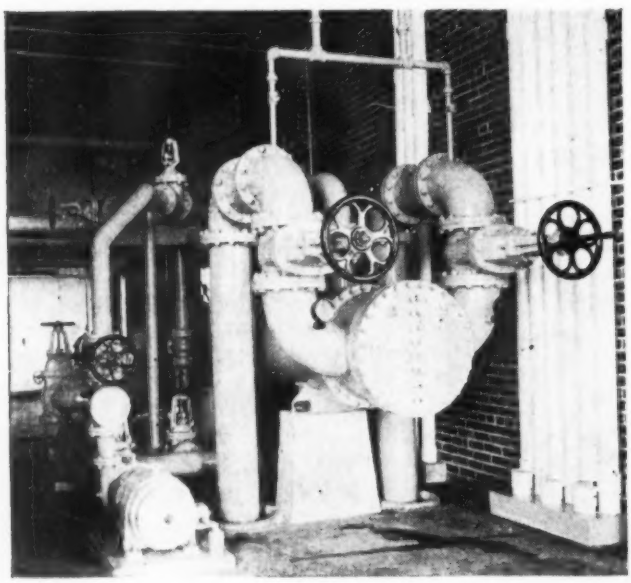


Fig. 5—Hydrogen-cooler heat exchanger, with 1048-sq-ft surface and 3-in. circulating pumps driven by 15-hp motors

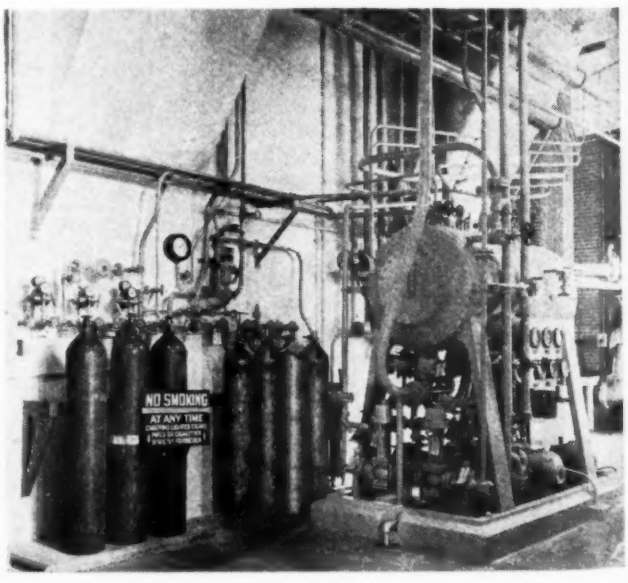


Fig. 6—Hydrogen piping from generator terminates in a manifold common to hydrogen and carbon-dioxide cylinders

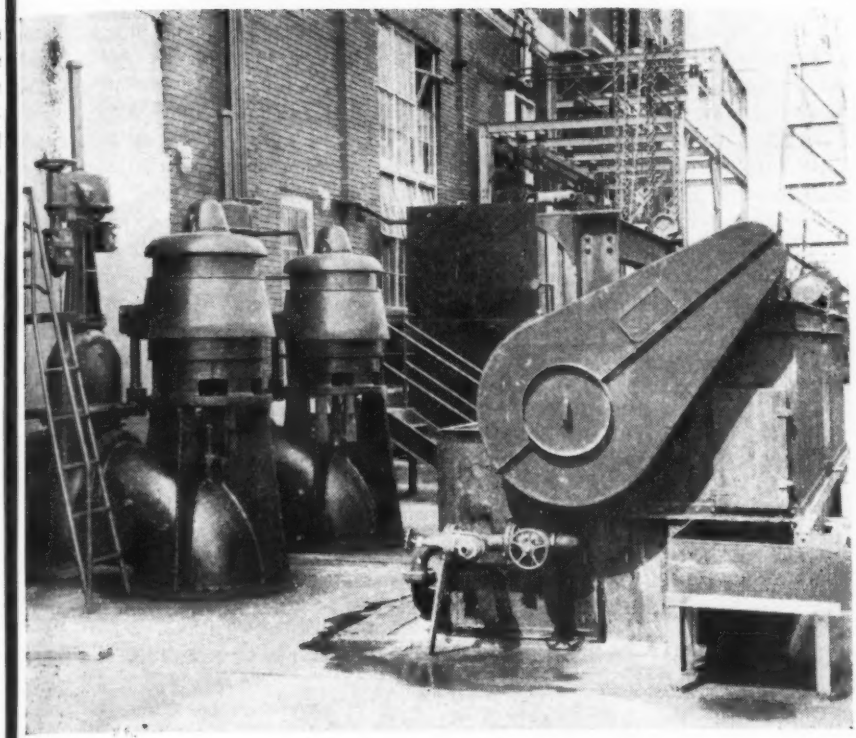


Fig. 4—Inlet circulating-water traveling screens and condenser circulating pumps. Each pump supplies half of the normal cooling-water flow. The sectionalized intake well allows cleaning without interrupting the unit's service

Feedwater for the entire station is supplied from a deaerating heater with storage capacity of 10,000 gal. The deaerator is operated at a constant pressure of 2 psig. There were some thermal advantages in operating it at variable pressure from one of the extraction points, but it is believed that disadvantages inherent in the system offset these advantages. The evaporator supplying the makeup discharges its vapor into the deaerator, and receives its steam supply for the coils from either the 9th- or 12th-stage extraction points, depending upon the load being carried and the makeup water requirements. Any additional steam needed by the deaerator, above that being supplied by the evaporator, is taken from the 12th-stage extraction line through a small reducing valve.

Owing to the low temperature of the deaerated water supplied to the boiler feed pumps, the three upper stages of feedwater heating are at full pump pressure. Therefore, it was necessary to use drainers and cascade the drains from the heaters into the deaerator. In the 12th-stage heater a drain-cooler section provides an appreciable thermal advantage. To eliminate a drain-removal pump for the 16th-stage heater, which normally operates below atmospheric pressure, the drainage is trapped to the condenser hotwell. This heater also contains a drain-cooler section; drain temperature is cooled to within 10 F of entering-water temperature. Three boiler feed pumps operate at about 1250 psi, each with a capacity slightly larger than one boiler. All are driven by squirrel-cage motors at 3550 rpm. By maintaining a pH of 8.6 and handling water at 220 F it is believed that corrosion or erosion now prevalent will be avoided.

All auxiliaries are electrically driven; at the time WPB gave approval it was very difficult to obtain mechanical-drive turbines. Since the new unit would be operated at base load and there would be times when the low-pressure station would be out of service, any steam-driven auxiliaries for the new unit would necessarily be supplied from the high-pressure header. This constituted another reason against selection of steam-driven auxiliaries. A 3-phase house-service transformer bank of 2000 kva capacity was installed, capable of supplying the new unit as well as part of the existing plant upon failure of one or more single-phase transformers of the existing 3000-kva house-service bank. Because the existing bank had only one low-voltage tap at 440 v, it was necessary to supply the 450-hp boiler-feed-pump motors at this voltage instead of the more desirable 2300-v supply.

Auxiliaries' Controls

The only steam-driven auxiliaries for the new unit are the condenser air ejector and the steam-driven auxiliaries for the turbine itself. Inasmuch as this station is well tied into the transmission system, there would be very little likelihood of not being able to obtain power for starting up even when no low-pressure equipment is in operation. All motors are controlled from a bank of metalclad withdrawal-type air circuit breakers, larger motors with individual switches, smaller ones supplied from distribution panels with magnetic contactors. All motors start across the line, with control switches at the motor and at either the boiler or turbine control boards.

The steel-plate turbine control panel, complete with a canopy containing recessed lights, mounts instruments and controls for the reducing and desuperheating station, generator field and stator temperature recorders, conductivity recorders, turbine steam flow, temperature and pressure recorder, stage pressure gages, mercury column, and speed and camshaft position indicators. The hydrogen control cabinet is built into the turbine control board.

All generators in the station operate at a nominal 11,000 v to supply prin-

EXPECTED PERFORMANCE DATA

Throttle steam: 850 psia, 900 F; Backpressure: 2 in. Hg. abs; Makeup: 1½% of feedwater flow

Generator output, kw	20,000	25,000	31,250
Turbine heat rate, Btu per kwhr	9,620	9,576	9,652
Boiler efficiency, %	85	87	86
Auxiliary power consumption, %	4.34	4.36	4.07
Operating factor, %*	98	98	98
Station heat rate, Btu per net kwhr	12,172	11,777	11,953

* Allowance for miscellaneous station losses

cipal substations in the city through a loop system. At the substation adjacent to the plant is a 15,000-kva 11/66-kv bank and a 66-kv transmission line leading out of the county to the remainder of the system, and to a 10,000-kva bank in another substation. The existing 11-kv switchgear at the plant was of 250,000-kva interrupting capacity, and installation of the new unit made it necessary that the additional switchgear be of 500,000-kva interrupting capacity. Consequently, the new switchgear serving the generator, additional house-service bank and additional outgoing feeders are located in a separate cell structure requiring for the new equipment a bus-tie inclosure and bus-tie switch.

Switchgear was obtained from the WPB surplus list. To protect the older switchgear a relay system opens the bus-tie switch first in event of a fault causing differential or overload relay operation on the old bus. This arrangement also permits inspection and maintenance of either bus section without a complete plant shutdown.

Operating results so far indicate that fuel economy and operation meet expected performance. No major difficulties were experienced in placing the unit in operation; simplicity of equipment and ease of operation assisted the operating crew greatly during the starting-up period, and will be reflected in low maintenance costs.

Company engineers handled selection of equipment, heat-balance studies and construction. Gilbert Associates, Inc, of Reading, Pa., had charge of the remainder of the engineering.

PRINCIPAL POWER-PLANT EQUIPMENT

Florida Power Corp's 25,000-Kw Extension Bayboro Plant, St. Petersburg, Fla.

BOILERS AND AUXILIARY EQUIPMENT:

Boilers, 2, integral furnace.....Babcock & Wilcox Co
2-drum, 175,000 lb per hr, design pressure 950 psi, 13,170 sq ft each, furnace vol 6600 cu ft each
Superheaters, 2, loop-tube convection type.....Babcock & Wilcox Co
4064 sq ft each with attemperator desuperheater in lower drum
Desuperheater control valve.....Bailey Meter Co
Oil burners, 4 per boiler.....Babcock & Wilcox Co
Steam-mechanical atomizing
Forced-draft fans, 1 per boiler, vane control.....B F Sturtevant Co
Test block 247,000 lb per hr at 105 F and 11.0-in. sp
Forced-draft-fan drive.....Fairbanks, Morse & Co
150-hp 1750-rpm induction motors
Induced-draft fans, 1 per boiler, vane control.....B F Sturtevant Co
Test block 290,000 lb per hr at 425 F and 11.3-in. sp
Induced-draft-fan drive.....Fairbanks, Morse & Co
250-hp 1160-rpm induction motors
Air heaters, 1 per boiler, tubular.....Babcock & Wilcox Co
19,000 sq ft heating surface each
Breeching and ducts.....Babcock & Wilcox Co
Feedwater regulator, 1.....Bailey Meter Co
4 in., 3-element control per boiler, air operated
Soot blowers, 10 per boiler unit.....Diamond Power Specialty Corp
3 Clyde retractable, 5 revolving, 1 stationary, 1 feed type for air heater
Water columns, 1 per boiler.....Diamond Power Specialty Corp
Bicolor, reflecting stands, high- and low-water alarms
Safety valves, 3 per boiler.....Consolidated Ashcroft Hancock Co
2 on drum, 1 on superheater
Non-return valves, 8 in.....Edward Valve & Mfg Co
Blowoff valves, 2 per boiler, unit tandem type....Yarnall-Waring Co
Protective coating, for drums *(Apexior)*....Dampney Co of America
Automatic combustion control.....Bailey Meter Co
Air operated, with steel control panel
Air compressors for control, 2.....Ingersoll-Rand Co
Size 5x5 in., texrope drive
Air-compressor drive, 2 .....Fairbanks, Morse & Co
10-hp induction motors, texrope drive
Stack, radial brick.....Alphons Custodis Chimney Construction Co
156 ft, 6 in. high by 12 ft inside diameter at top (200 ft above ground level)
Fuel-oil heaters, 2, shell and tube, 5 pass.....Griscom-Russell Co
Fuel-oil pumps, 2.....Quimby Pump Co, Inc
60 gpm, 250 psi
Fuel-oil-pump drive, 2.....Fairbanks, Morse & Co
20-hp induction motors
Fuel-oil booster pump, 1, with 5-hp motor.....Quimby Pump Co, Inc
Deaerating heater, 1.....Cochrane Corp
400,000 lb per hr, with 10,000 gal storage
Evaporator, 1.....Westinghouse Electric Corp
7500 lb per hr, 188-sq-ft coil surface
Raw-water softener, 2.....Permutit Co
24 in. by 8 ft Zeo-Karb, 20 gpm each
Boiler feed pumps, 3.....Pennsylvania Pump & Compressor Co
420 gpm, 3 stage, 1100 psi
Boiler-feed-pump motors, 3.....Allis-Chalmers Mfg Co
450 hp, 3600 rpm, induction
Extraction feedwater heaters, 4.....Alco Products Div
Straight tube
Feedwater-heater drainers and miscellaneous small reducing valves..
Fisher Governor Co
Reducing and desuperheating station.....Republic Flow Meters Co
850 psi, 900 F to 300 psi, 600 F, 125,000 lb per hr
Desuperheater pumps, 2.....Aurora Pump Co
Turbine pumps in series with 40-hp motor
Piping and valves for steam and water....Crane Co, Grinnell Co, Inc, Walworth Co, Atwood & Morrill
Pipe-covering materials.....Johns-Manville Corp

GENERATING EQUIPMENT:

Turbine-generator.....General Electric Co
25,000 kw, 31,250 kva, 11,000 v, 3600 rpm, 850 psi, 900 F, 2-in.-Hg backpressure, 4 stages bleeding; with hydrogen-cooled generator and direct-connected room-ventilated exciter
Hydrogen-cooling heat exchanger, 1048-sq-ft surface.Alco Products Div
Hydrogen-cooling heat-exchanger pumps, 3....Fairbanks, Morse & Co
3-in., with 15-hp motors
Condenser, single pass.....Westinghouse Electric Corp
Divided water box, 23,000 sq ft, aluminum-brass tubes, Muntz sheets, steel welded shell, cast-iron boxes
Circulating pumps, 2, vertical propeller.....Fairbanks, Morse & Co
30-in., 20,000 gpm each, with 125-hp hollow-shaft 585-rpm vertical induction motors
Condensate pumps, 2, centrifugal.....Westinghouse Electric Corp
2-stage, horizontal, 450 gpm each
Condensate-pump drive.....Fairbanks, Morse & Co
Two 40-hp 1160-rpm induction motors
Air pumps, tube-jet.....Westinghouse Electric Corp
1, twin, 2-stage, 300 sq ft inter- and after-condensers
Traveling screens, 2.....Chain Belt Co
20,000 gpm each, 8-ft-wide baskets
Screen wash pump, 1.....Fairbanks Morse & Co
300 gpm, 200-ft head, 30 hp, 1750 rpm
Circulating-water piping.....U. S. Pipe & Foundry Co
30, 36 and 48-in. cast-iron pipe and fittings, flanged, hot tar dipped
Circulating-water valves, 4.....Chapman Valve & Mfg Co
30 in., motor operated
Lubricating-oil filter, 1.....Bowser, Inc
Size 2 turbine-oil conditioner
Recorders, CO_2, generator and field temp, conductivity.....
Leeds & Northrup Co
Turbine flowmeter, condenser temperatures.....Bailey Meter Co
Misc gages and thermometers.....Manning, Maxwell & Moore, Inc

ELECTRICAL EQUIPMENT:

Auxiliary switchgear .....Roller-Smith Co
Metalclad, 440 v, withdrawal-type air circuit breakers
Auxiliary house-service transformer, 1.....General Electric Co
3-phase bank, 2000 kva, 11,500/460 v, indoor, pyranol filled
Main-bus switchgear, 6, ocb, 15 kv, rebuilt.Westinghouse Electric Corp
Main control and relay panels.....General Electric Co
Cable and wire .....Kerite Insulated Wire & Cable Co

PRINCIPAL CONTRACTORS:

Foundations, underground structures.....Raymond Concrete Pile Co
Structural steel.....Belmont Iron Works, Ingalls Iron Works Co
Structural-steel erection.....White Construction & Engrg Co
Building and general work.....R E Clarson, Inc
Piping, 1940 boiler plant.....American Power Piping Co
Piping, turbine extension.....Grinnell Co, Inc
Pipe covering.....Brooks Fisher Insulating Co

Plant Studies Better the Operation Of Modern Well-Planned Building

L E Kelley, maintenance engineer of Tiffany & Co, New York, has practical down-to-earth ideas about supervising the operation and maintenance of a building and its machinery. Here are several of them, as told to Gene Feller, associate editor

▶IN TIFFANY & CO'S BUILDING, dirt and dust have no place. They would pollute the atmosphere and damage valuable merchandise and machinery. If they collected inside elevator shafts they would constitute a fire hazard. Too often an otherwise efficient dust eliminator at fresh-air intakes is ineffective because air enters through frequently opened doors and leakage points in areas that have a slightly negative pressure. Then stack effect inside the building carries the dust to upper floors. At Tiffany's, close pressure regulation in the air-conditioned space prevents dust-laden outside air entering, and tight-closing doors to stairwells and elevator shafts reduce or eliminate updraft that circulates the dust. Swinging doors are self closing and sliding ones fitted with suitable seals to make them tight.

Mr Kelley feels that a gravel roof offers advantages over tile when fresh air intakes are located nearby. On smooth tile, dust that has settled, is constantly stirred up by passing breezes and carried into the roof drains or air intakes to overload the filters greatly. Only remedy is to flush the roof regularly, a costly procedure when water rates are high. Loose gravel, on the other hand, holds the dust particles, which rainfall will later flush away.

Another tile-roof problem is the effect of solar heat. Temperatures of 140 F are not uncommon at the tile face and cause serious expansion of both the tile and underlying layers of sand and asphalt. Expansion moves the tile progressively in one direction; in some instances it has actually moved parapet walls that surround the roof. Tile movement is sometimes evidenced by the holding bolts between roof drain plate and lower bowl being snapped off.

The asphalt, penned in by the overlying layer of cemented tile, follows the path of least resistance, flowing through side weep holes into the roof drain head. Congealing again after leaving the heated area, it soon closes the drain pipe completely, especially if the line bends just under the roof. Even if one or two clogged roof drains did not interfere seriously with normal precipitation runoff, fire in an adjacent building might result in tons of water being thrown on the roof. Retarded drainage not only puts a heavy load on the roof, but the rising water might seep through open vents or penthouse doors and cause serious damage to valuable equipment or merchandise in lower areas.

Study the possibility of fires originating from an outside conflagration as well as the inside hazards. Flying embers, from a nearby fire, landing in the top of an idle cooling tower can destroy the unit before the fire is discovered. Screening the opening in an induced-draft tower to catch large objects is not practicable because snow and ice loading introduce a serious problem. (Exhaust vents 20 to 30 ft in diameter are not uncommon.) Tiffany & Co are now contemplating installation of a complete sprinkler system inside their cooling tower.

Fire equipment includes (1) complete sprinkler system (2) first-aid extinguishers strategically located throughout the building (3) fire hose connected to standpipe outlets and ready for instant use. As originally installed, linen fire hose was 2½-in., an unwieldly size because when under full pressure the nozzle has to be held by several men. To speed up fire-fighting procedure all 2½-in. hose has been replaced with 1½-in. so that, in an emergency, one man can hold the nozzle and direct the water stream with ease. Wet hose is dried by hanging it in a stairwell and connecting the warm exhaust from a portable vacuum cleaner to one end. When dry, the hose is again folded on its rack. Some authorities recommend folding linen hose at new points after it has been hanging for some time, to distribute more evenly bending stresses in the fibers. Kelley is of the opinion that this advice is wishful thinking because the original folds cannot be removed unless the hose is made wet and then repressed. Fur-

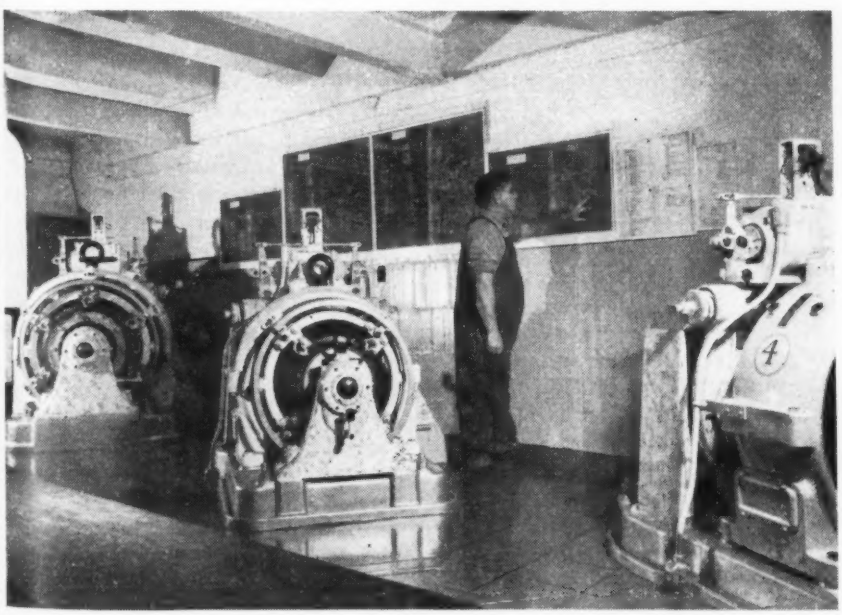


Fig. 1—Thomas Gallagher, elevator mechanic, shows how convenient it is to study wall-mounted wiring diagrams. They also help speed up trouble shooting

Fig. 2—Mounted inside the stock room is a tool board, which holds the varied assortment of hand tools needed in everyday maintenance work around the plant

thermore, if folds weaken the hose it is more practical to have twelve than 24 weak spots in one length.

The major loss does not always come from the fire itself; sometimes water, as well as using the incorrect first-aid extinguisher, causes even greater damage. Always purchase the first-aid extinguisher that is most suitable for the type of fire liable to occur and that will do the least damage to valuable merchandise and equipment. Then give it a prominent place within easy reach.

As further protection against water damage, Tiffany & Co found it advisable to install water-flow indicators in branch lines feeding the sprinkler heads. Failure of two heads at different times demonstrated the need of a centralized warning system that would reduce the time needed to locate trouble.

Cooling towers are another possible source of water damage. Either the constant patter of water, falling on the sheet-copper bottom, or temperature changes, causing expansion and contraction, may open a seam or fatigue and crack the metal. It is almost impossible to locate a leak of this kind because the water may follow a crack in the concrete or along the reinforcing steel and come into the open many feet away from the actual source. To guard against this possibility and protect the inner metal parts against water action Tiffany & Co covered the cooling-tower bottom with cotton duck thoroughly impregnated with insulmastic. A thinner mixture of the same compound covers all other inside metal parts and inlet louvers.

Good housekeeping does not end in the showrooms and offices but is practiced throughout to the furthermost basement and machinery room. Pumps, motors and elevator hoists are painted white and the slightest oil leak is soon spotted and, once seen, quickly corrected. Stationary brackets and supporting structures on elevator hoists and limit switches are painted a mottled white to distinguish them from rotating parts, Fig. 1. Here judicious use of paint helps prevent accidents.

Normal updraft through the shaft carries considerable dirt and dust into elevator-machinery rooms. At Tiffany's the main machinery rooms are maintained under a slight positive pressure to counteract draft effect of the shafts. Other rooms subjected to this draft are protected by easily replaceable dry filters that cover all openings, Fig. 3.

Atmospheric moisture condensing on water-carrying pipes and tanks not only is unsightly but corrodes the metal as well. Painting the surface does not offer complete protection because the moisture usually follows along the underside of a tank and gets into crevices that cannot be painted unless the tank is disconnected and elevated. This has been overcome by applying a thick coating of insulmastic and cork to tanks in which the water supply is constantly renewed. Dead-storage tanks do not sweat and therefore painting keeps them in good condition.

Rather than make responsibility a one-man job, Kelley encourages every person to share in it according to his ability. The policy of employing men that fit individual jobs has given him a staff that is conscientious, capable, and dependable. He believes that giving the other fellow a break encourages in him a feeling of obligation to cooperate in making a smooth-running organization. As a follow-through, the maintenance staff keeps a watchful eye on office and store equipment (chairs, desks, showcases and doors) to minimize complaints from other company employes.

In an air-conditioned space thermometers may cause unwarranted complaints because the variety attached to thermostat covers are sometimes inaccurate or, if accurate, are not read correctly by persons of different height. To a tall person the thermometer may read several degrees lower than to one of normal or short stature. Best solution is to remove all thermometers.

Be Informative

Many engineers resent being questioned by managers or auditors about the purpose and operating cost of plant machinery. Rather than feel that this is a reflection on their ability or judgment, they should make a special effort to explain the function and cost of equipment to persons responsible for company finances. Thus a bond of mutual trust and respect is formed and management soon learns to trust and depend on the engineer's judgment. Kelley keeps this information in a monthly log, which shows the daily consumption of water, steam and electricity, the total amount used and the monthly cost of each. Machinery records consist of a running history of each piece of equipment starting with complete nameplate data, Fig. 4, and following through with an entry for each replacement, addition or repair job. Thus pertinent information is always up

Fig. 3—Filter A prevents dust from elevator shaft entering control area

to date and readily available for study.

To facilitate operation and maintenance and keep the working force to a minimum, starting control for the various motors in each area is grouped on one panel. Thus time consumed for complete start up and shut down is held to a minimum and one man does the work that ordinarily might require two. A kwhr-meter receptacle in each motor circuit permits connecting test meters without breaking into permanent wiring, and a complete wiring diagram, Fig. 1 and 3, is framed and mounted near each machine. A complete set of maintenance hand tools furnished by the company hangs on a large tool board, Fig. 2, in the stockroom adjacent to the main compressor room.

Kelley feels that the greatest accident hazard in office and store buildings is introduced by indiscriminate use of elevator shaft-door keys. He maintains strict supervision over their use, issuing one only when a job requires it. At other times they remain under lock. Thus the necessity of following a special procedure to obtain a key recalls to the user's mind the danger attendant upon its use.

Elevator inspection is rigid. Every six months the inspector, wearing close-fitting gloves, passes every inch of cable through his hands to locate broken wires. Wire rope manufacturer's representative accompanies the mechanic on this inspection. Supplementing the periodic mechanical inspection of equipment, Kelley makes a tour of the entire building every six months, making note of all items that need attention. The list then becomes a fill-in job order until everything is shipshape. By saving this work for slack periods the normal crew do it without extra cost and at the same time have more uniform working conditions. Rushing a lot of odd jobs to completion requires either outside help or a larger staff—one fully occupied part of the time but with too much time to kill between rush periods.

Mr. Kelley is especially suspicious of pressure or pinch points between conductors on newly-wired control panels. Once (after hours of work) he found this the source of trouble that caused an elevator outage and so he makes it a point to rearrange new control wiring so that insulation is not subjected to external pressure.

Air-conditioning system is sub-divided into six independent horizontal zones with separate supply and return ducts. Major part of the mechanical equipment—intake filters, precipitrons, cooling, tempering and heating coils, humidifiers, and supply and return fans—is located on two floors of the penthouse. A grating in the separating floor equalizes internal air pressure between the two areas, and a roof vent releases air discharged through spill dampers in the return ducts from conditioned areas. Position of spill dampers determines the amount of fresh air that enters main intakes by spilling a percentage of the return air (enough to remove fumes and odors, and keep the atmosphere fresh).

In winter, leakage through the automatically operated louvers in front of the main air intakes introduced quite a problem. It was impossible to adjust them so they would close tight and since too much cold air entered, a fireproofed barrier with several tight-fitting doors was erected just inside each main intake.

Ingenious Setup

When weather is extremely cold the doors are kept closed and an ingenious system of operation set up. Main supply fans are operated at normal speed but the return fans are slowed down. Thus instead of part of the return air flowing out the spill opening into the room, low speed of the return fans sets up a slight negative pressure at the spill opening and room air enters as fresh makeup. In this way the roof vent, instead of discharging spilled air, acts as a fresh-air intake. A set of dry filters removes most of the entrained dirt before the air enters the room, where it picks up a slight preheat before going into the main cleaning and heating chamber through the spill damper. Regulation is such that excess air, putting a positive pressure in conditioned areas, leaks out through windows and doors. Therefore, cold-air blasts do not enter when outside doors are opened; sufficient fresh air is ad-

(*Continued on page* 148)

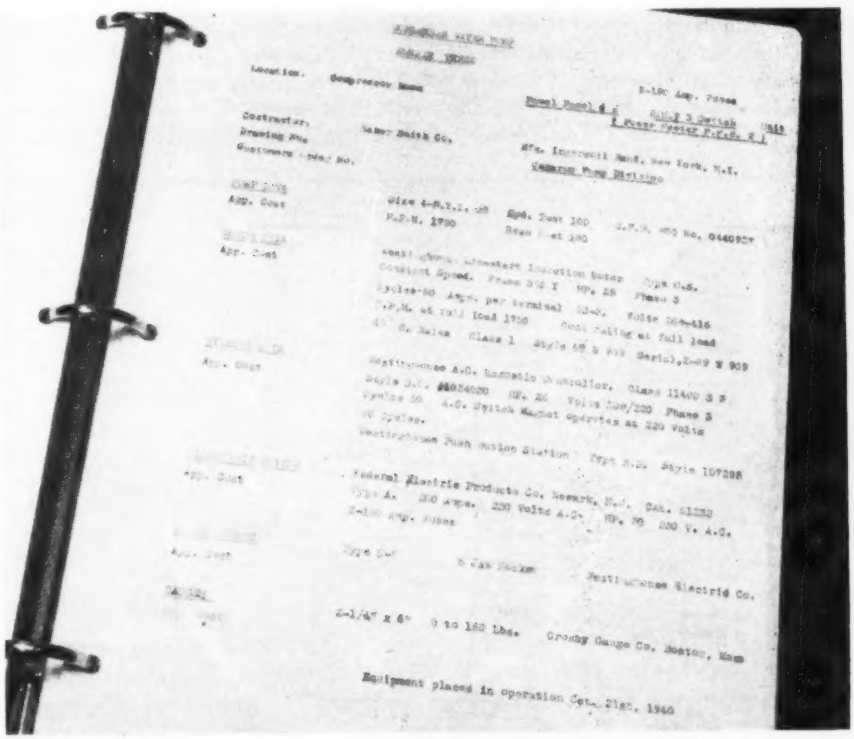


Fig. 4—Pertinent machinery data is recorded in a looseleaf book so that extra pages can be inserted as needed. Maintenance entries are kept up to date

Modern Runner Designs Rejuvenate

H S Van Patter, manager and chief engineer, hydraulic division, Dominion Engineering Co, tells how hydraulic-turbine capacity in three large Canadian plants was increased up to 50% by improved runners in old settings. At the same time efficiency was increased and cavitation troubles eliminated

► THE POSSIBILITY of increasing hydraulic-turbine capacity, as shown by extensive model testing, has centered attention on rebuilding the turbines in existing settings. When practicable, such rebuilding pays big dividends on the investment because cost per horsepower for added capacity is usually only a fraction of the original installation's cost.

The two types of modifications described here, with data from several reconstructed installations in Canada, are: (1) Changes to the runner and, sometimes, to adjacent parts such as throat ring and guide vanes, but only where the greater part of an existing turbine is used. (2) Completely new design of turbine in an existing setting where casing and draft tube have been constructed and their size cannot be increased.

Determining how much a turbine's capacity can be increased usually requires tests on models, particularly if the existing setting's runner elevation cannot be changed. In addition to the usual power and efficiency tests, cavitation tests are made to guard against trouble from pitting and vibration.

LaGabelle plant offers an example of improved hydraulic-turbine performance and boosted capacity. On the St. Maurice River, near Three Rivers, Quebec, this plant is owned and operated by the Shawinigan Water & Power Co, Montreal. Its first four units, with fixed-blade propellers, are each rated 30,000 hp under a 60-ft head, a record for this type when it was designed in 1923. When the plant was constructed, there was a possibility that the head might be increased later to 64 ft by reducing the tailwater elevation. Generators were, therefore, rated to correspond to the turbine capacity under the higher head.

Turbine design was based on model tests made in two U. S. hydraulic laboratories operating under heads of about 10 ft. Cavitation tests were not possible then, selection of speed and draft head being based on theoretical considerations and past experience with francis runners. When this plant was constructed, the Shawinigan Water and Power Co designed at Shawinigan Falls, a hydraulic-turbine model-testing plant for heads from 55 to 75 ft, arranged to vary tailwater level over a wide range. This was the first cavitation laboratory for hydraulic turbines in the Western Hemisphere.

Serious difficulties were experienced with the original runners at LaGabelle resulting from severe cavitation, which pitted the runners and throat rings and caused draft-tube liners to fail. Accordingly, extensive model testing was done at Shawinigan Falls to improve the design for a fifth unit for LaGabelle, and to determine whether the original units could be modified to eliminate cavitation. After the design of unit No. 5 was decided, testing continued for several years to determine whether the original turbines' capacity under 60-ft head could be increased to equal that of their generators. An improved design of larger capacity has now replaced all four of the original runners.

Design Changes

Fig. 3 shows one of the original 6-blade runners, with blade width about the same at the periphery as near the runner hub. This runner was replaced by a new one, Fig. 4. It also has six blades but a much greater blade area at the periphery, which has greatly assisted in eliminating cavitation troubles.

Fig. 1 shows an outline section *A* through the original runners and the latest modified design, *C*. The new runner is much deeper and has been low-

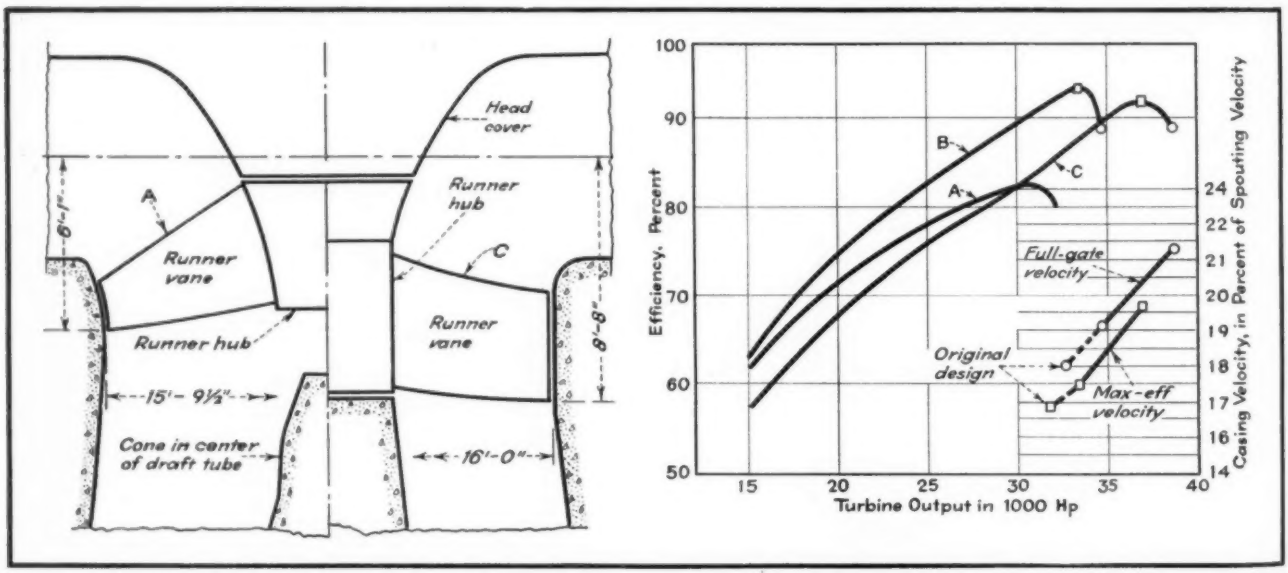
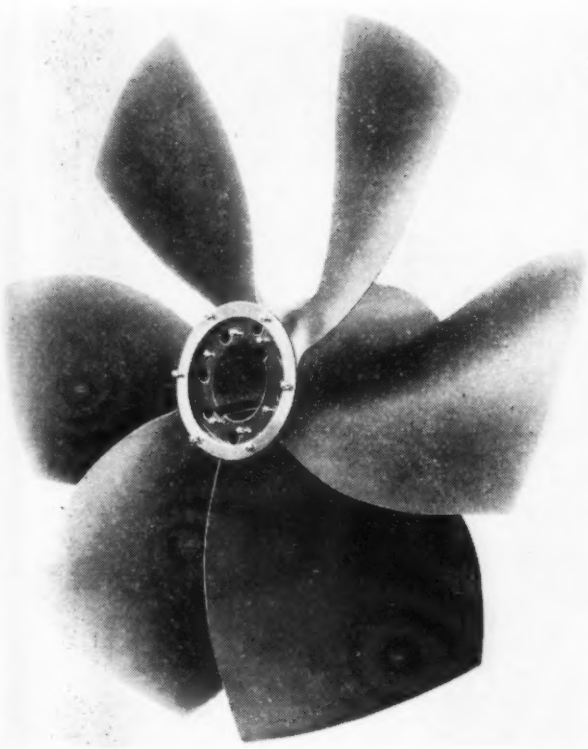


Fig. 1—A: outline of the original runners and settings in the LaGabelle plant, and C: outline of the modified ones

Fig. 2—Curves A, B and C: test results of LaGabelle turbines before and after changing the runners and settings

Out-Dated Hydraulic Turbines



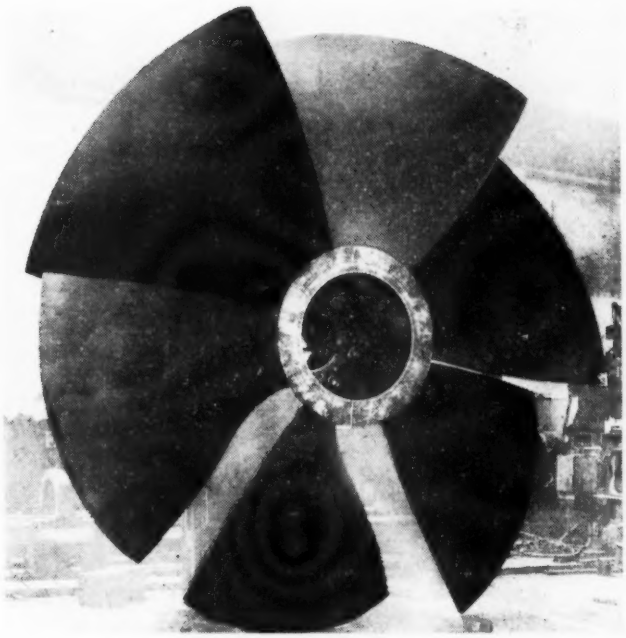


Fig. 3, (left)—Original 30,000-hp 60-ft head propeller-runner design, LaGabelle plant, Shawinigan Water & Power Co. Fig. 4, (above)—Improved runner replaced Fig. 3, and gave an increase in power output of about 9000 hp

ered so that its blades' bottom edges are about 2.5 ft. below those of the original design. Flow into the runner is more nearly axial and the distance between bottom of guide vanes and runner-blade inlet edges has been increased. New guide vanes of modified shape were installed in place of the old ones. Also, a new lower distributor ring, throat ring, and draft-tube liner were installed in addition to the new runner. Remaining turbine parts were not altered, and the old runner hub was used by cutting off its blades and attaching the new ones to it.

The curves, Fig. 2, were obtained from field tests made at LaGabelle before and after reconstruction. Curve *A* is from a test made on one of the original units after about ten years' service. Efficiency had dropped about 6% from that obtained immediately after installation because of damage from cavitation. Curve *B* shows performance of the first reconstructed unit. Its capacity has been increased about 2500 hp and its maximum efficiency raised about 10%. Installed early in 1934, this unit has proved so satisfactory that it was decided, after making additional model tests, to install design *C* in another turbine in 1937, which performed as shown by curve *C*, Fig. 2. The full-gate capacity of this unit is nearly 9000 hp (30%) higher than the original rating of 30,000 hp. This large capacity increase was obtained without any appreciable sacrifice in maximum efficiency, as the curves indicate. The lower curves, Fig. 2, show spiral-casing velocities in percent of spouting velocity for the three designs at best efficiency and at full gate. The two remaining old units were reconstructed to design *C* in 1938 and 1941. All operate satisfactorily with practically complete freedom from cavitation troubles.

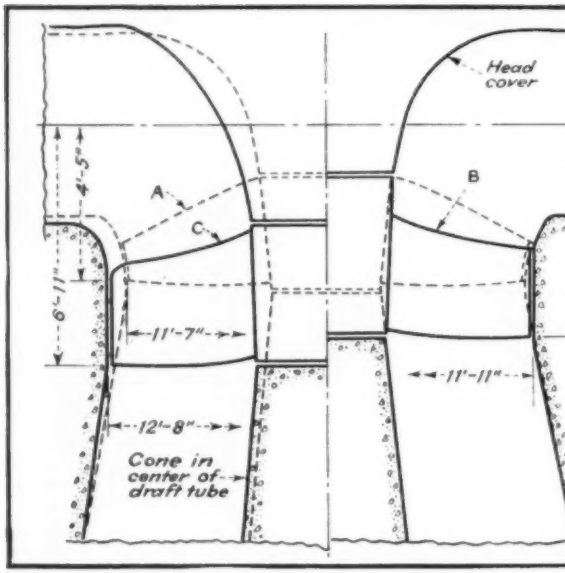
Churchill River Plant

In the Churchill River Power Co plant, on the Churchill River, Island Falls, Sask., reconstruction has been similar to that at LaGabelle. At Island Falls the original installation had three 14,000-hp 56-ft head 163.6-rpm fixed-blade propeller turbines, designed in 1928 with runners 139 in. in diameter. When this plant was built, the casing and draft tube for unit No. 4 were partly constructed, so that its water-passage areas were fixed. When this unit was constructed in 1935, an increase in its rating was desired. After careful study, based on model tests at Shawinigan Falls, it was found that this turbine's rating could be increased to 19,000 hp by using a runner design similar to that at LaGabelle, 152-in. diameter operating at 150 rpm.

Unit 4 went in service in 1937 and operated so satisfactorily that a fifth unit was installed. It was decided to reconstruct units 1, 2 and 3 to increase their ratings from 14,000 to 16,500 hp by changing their runners, throat rings, and draft-tube liners. Fig. 5 shows outline sections of the three designs: *A* is the original design of units 1, 2 and 3; *B*, reconstructed units 1, 2 and 3; and *C*, design of units 4 and 5. In general the changes are similar to those at LaGabelle. Casing and draft tubes are the same for all three designs, except small modifications to suit runner and guide-vane dimensional changes.

Fig. 6 compares power efficiency curves for the three runner designs based on model efficiency tests and field power readings for designs *A* and *C*. Full-gate capacity of design *C* is nearly 50% greater than the original-setting rating.

The Shawinigan Water and Power Co has also increased capacity of units installed in its Grand Mere plant. When the Laurentide Power Co built this plant in 1915, it had six 20,000-hp francis units operating under a 76-ft head, which was later increased to 80



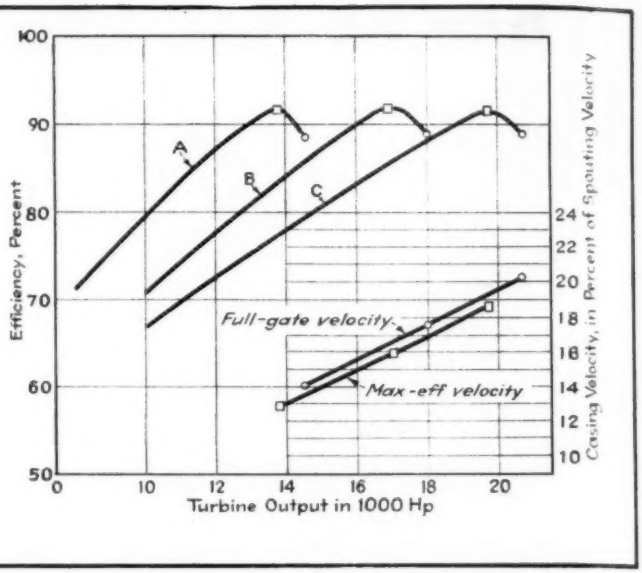


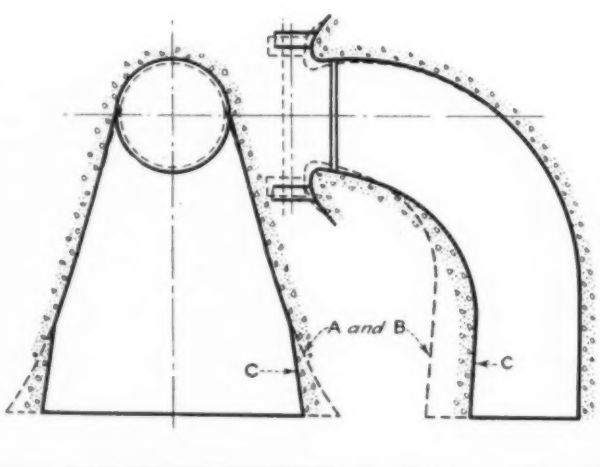
Fig. 5, (left)—A: outline section of original propeller runners and settings in Island Falls plant; B and C are modified runners and settings. Fig. 6, (right)—Curve A shows the efficiency and power output of original runners in Island Falls plant; curves B and C show the power and efficiency obtained from modified runners and settings

ft. Comparative outputs will be based on the latter head. Two additional duplicate units were installed in 1921. Concrete spiral casings and elbow draft tubes for nine units were constructed when the original plant was built. The turbines had cast-iron runners, some of which after long service developed serious fatigue cracks in the runner blades adjacent to the crown. Because of this condition five runners have been replaced with cast-steel ones.

A ninth unit for this plant was ordered in 1929. Before building it, experimental studies were made, in cooperation with Prof Charles F Allen, in the Alden Laboratories, Worcester Polytechnic Institute, Worcester, Mass., to determine whether a larger unit could be installed and draft-tube efficiency improved by modifications to the existing setting. Based on these studies the turbine was designed for 24,500 hp under 80-ft head at 112.5 rpm with modified draft tube. The new runner has a 149-in. throat diameter, compared to 131 in. and 120 rpm for the original units. Fig. 7 compares the draft tube design of the original units, indicated by dotted lines *A* and *B* and the modified design, full lines C, for unit 9.

Field power-gate tests of an original unit with a cast-iron runner, and of the same unit with a cast-steel runner, showed a 1250-hp increase for the latter at best efficiency. As no alterations were made to the draft tubes the 1250-hp increase may be attributed to thinner blades of the cast-steel runner providing greater outflow area and to an improved runner design. Fig. 8 shows field-test performance of the original units with cast-steel runners and unit 9. A 1.5% increase in efficiency and about 20% in power (4400 hp) is obtained.

The hydraulic turbine-testing plant of Dominion Engineering Works, Limited at Lachine will facilitate further work of this character. The plant has complete equipment for testing 16-in. model turbines, with casings and draft tubes, under a 10-ft head. The runners, also, can be installed in the model turbine at the Shawinigan Water and Power Co's testing plant, thus permitting complete tests, at that company's plant when the work does not interfere with the owner's testing program.



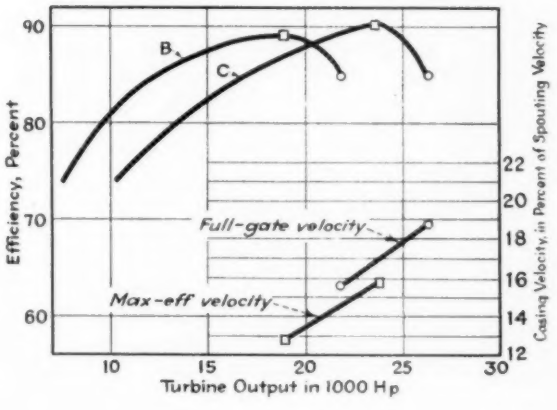


Fig. 7—Outline of the original and the modified draft tubes for francis runners installed in the plant at Grand Mere

Fig. 8—B and C: Efficiency and power curves show the results of design changes of turbines and draft tubes, Fig. 7

Inclined Screw With Swinging Spout Solves Handling Problem, Saves Labor

By R R WILL, *Link-Belt Company*

▸IN LARGE BOILER PLANTS there are many ways to solve the coal-handling problem. Such layouts use various combinations of overhead bunkers, bulk conveyors, elevators, belt conveyors, screw conveyors and other conventional devices. But in smaller plants, with space limitations and other factors that preclude normal arrangements, engineers often must use considerable ingenuity in devising semi-automatic handling. This problem proved particularly tough during the war when fuel shortages demanded conversions, and dearth of manpower made labor-saving unusually important. Many of these emergency solutions will find application under normal conditions.

A case in point is that of Economy Fuse & Mfg Co, Chicago, where it was necessary to convert to coal two boilers that heated plant and office space. Hand firing would have required boiler-room manpower, which was unavailable, and which would have been uneconomical even if available. Stokers would make firing automatic and effect considerable savings in steam cost, but there would still remain the question of getting coal to stoker hoppers without extra manpower. This was solved by installing an inclined screw conveyor with swinging discharge spout that did away with the necessity for alterations to the existing boiler-room layout or for structural support.

Stoker coal moves directly from bottom of floor-level coal bin, fitted with sloping sides for self feeding, through a screw conveyor tube at an angle of about 45 deg. The screw thus accomplishes the combined functions of a conveyor and an elevator. The screw-conveyor discharge spout has a hinged section so that it delivers coal into either of the two stoker hoppers. Stokers have fan mounted integrally with the transmission, and are rated at 500 lb of coal per hr. Link-Belt Co furnished and installed conveyor system and stokers.

Fuel savings, resulting from use of Southern Illinois stoker screenings, are not available, but D L Davis, factory manager of Economy Fuse & Mfg Co, estimates that boiler-room labor savings exceed $580 per month. A cleaner boiler room is another advantage of this coal-handling arrangement.

Right: Inclined-screw conveyor rises from floor-level bin at left; hinged spout permits feeding either of two stoker hoppers. Below: Closeup shows screw-conveyor feed end in bin with sloping sides for self feeding. Coal has been cleared away to show flights

Full Use of Simplified Log Sheet Improves Boiler-Room Operation

This plant finds that a carefully designed form saves time, helps keep operators on their toes by fixing responsibility, provides information needed to check plant performance, and plays major part in training and guiding new personnel

By H M BRADLEY
Plant Engineer
Manning, Maxwell & Moore, Inc

▶ THE AVERAGE ENGINEER or fireman shows a natural tendency to slight paper work, preferring the more important task of operating and servicing his equipment. A long stride in making necessary paper work as easy as possible lies in regular use of a log sheet, carefully designed to cover important data and records.

The boiler-room log on the facing page shows the form we worked out to fit our particular plant conditions. In addition to the usual feed pumps, heaters and other auxiliaries, we operate three boilers and a number of air compressors of different sizes. We made every effort to incorporate in the one form all the vital information peculiar to this installation. It is, therefore, suitable only for our own use, but it might well serve as a starting point for another plant in the development of a log sheet. The way we use the log to train operators and improve methods would, of course, apply anywhere.

Primary Purpose

Primary purpose of this or any other log is to make easy the recording of every action or event that occurs in each 24 hours of operation. Advantages of such a form are numerous:

1. Entries can be checked off readily by the operator on duty, relieving him of preparing detailed reports that may be hard to find when most needed. Its use thus frees him for the more important work of servicing the equipment for which he is responsible.

2. By clearly outlining every point to be covered, it serves to prevent neglect of operating details. It is also a useful guide in training new men.

3. The log helps to keep the operating force on its toes, and sustains interest in plant performance and maintenance.

4. The record definitely fixes responsibility, eliminating questions and arguments. The operator in charge must sign the sheet at the end of his shift, thus assuming responsibility for it. On taking over, the man on the next shift must check to see what happened on the preceding shift. If the operators are licensed men, their licenses are clearly at stake, and they will naturally be on their toes.

5. The log's data assist insurance and boiler inspectors, since the daily operation of equipment can be checked for cause and effect as far back as necessary.

6. Instead of wading through detailed reports, the plant engineer glances at the sheet, quickly grasping information he needs to check costs and operations. Comparison of log records over a period of time gives a clear picture of plant performance.

7. Finally, the log data keep management posted on value received for money spent in the power plant. Thus the log proves a good selling point for the plant engineer when he needs new equipment or repairs and must show management the reasons why.

Our boiler-room log plays an important part in training new men. When an operator starts work, he is first introduced to all the men with whom he will come in contact. Their relationship to him and his job is carefully explained. This helps him to feel that he is part of an organization working for a common purpose. Next, he is taken on a tour of the department by the chief engineer, under whose charge he will remain until he is ready to assume shift responsibility. Then we show him the log and impress him with the importance of recording on it all that happens in the boiler room, explaining his duties something like this:

"You will log outside-air and fuel-oil temperatures, compressed-air and steam pressure every hour, and note the time you start or stop boilers, induced-draft-fan and compressors. Note on the log sheet how many times you blow down boilers and feed heaters on your shift. When you start a shift, check the trycocks, make soap checks of water softeners, blow them down and flush them, check the feedwater heater and note the condition of boilers and equipment, recording these items in the log. Each day, check fuel-oil-tank meters and figure consumption and oil on hand; also read water meter, and record water consumption.

Operating Instructions

"In checking air compressors, keep all lubricators filled and note feed; hand-oil moving parts of equipment where necessary. Clean and polish all brass and keep work areas clean. Enter any signs of wear and tear on equipment in the log. Keep constant watch on boilers; be sure water level is kept as near to two gages as possible. Clean oil burners and strainers every shift.

"On the first shift, check all controllers and recorders and change charts. Lubricate all reducing valves twice a week. Regenerate water softeners as soon as water does not sud with five drops of soap. The senior engineer will make all chemical analyses of boiler water but you are expected to familiarize yourself with the process."

After a week of instruction the new employe makes a written report detailing how to start up and shut down the equipment under his charge. Such a report might read like this:

"To shut down the boiler, close both valves on the heating line in the boiler and compressor room. Then shut off the hot-water system, making sure that the valve on the left side of the Honeywell valve is closed, and shut down the circulating pump. Shut down high-pressure compressor and raise

(*Continued on page* 146)

H-20 Monday 13,800 Gals.
4

M. M. & M. BOILER LOG

BRIDGEPORT WORKS

Date Wednesday 3-7-45

DATE	BOILER No. 1 START	BOILER No. 1 STOP	BOILER No. 3 START	BOILER No. 3 STOP	BOILER No. 4 START	BOILER No. 4 STOP	Steam From	Steam To	OIL CONSUMPTION	TRY COCKS	BOILER BLOW DOWN	SOOT BLOWER	WATER ANALYSIS	WATER BOILER	SAFETY VALVE CHECK	FEED WATER HEATER BLOW DOWN	INDUCTION DRAFT FAN Start A.M.	INDUCTION DRAFT FAN Stop P.M.	WATER CONSUMPTION	AIR PRESSURE LBS.	HIGH PRESSURE AIR Start	HIGH PRESSURE AIR Stop	LOW PRESSURE 150 H.P. Start	LOW PRESSURE 150 H.P. Stop	LOW PRESSURE 75 H.P. Start	LOW PRESSURE 75 H.P. Stop	WATCHMAN'S TEMP. REPORT	OUTSIDE TEMP. A.M.	OUTSIDE TEMP. P.M.	OIL TEMP.	REPAIRS AND REMARKS
	CONTINUOUS		DOWN		5:00 AM	6:00 AM	600	136	DAILY	DAILY	DAILY	EVERY DAY	DAILY		WEEKLY	EVERY SHIFT			DAILY	HOURLY										DAILY	
					7:15 AM	7:15 AM	600		2584	#1-#4	#1		#1				DOWN		13,800	90	6:30 AM								190°	2 lbs. D314 H.P. Compound #1 Boiler D.W.
6 a.m.					8:05 AM	8:15 AM	600					#1-#2	#4							90								30°	190°	Results of Analysis of Boiler Water Boilers
7					8:45 AM	8:53 AM	600													80								32°	190°	#1-#4 Dia Record Book G. Elliott
8					9:45 AM	9:51 AM	600									220° DW (Blow) Down				85								34°	190°	Checked Compressors at Delta Wash 2:30 P.M.
9					10:15 AM	10:22 AM	600													90								44°	190°	Truck #28 delivered 2584 gals. of fuel Oil G.P.I
10					10:52 AM	10:59 AM	600				#1									85								48°	190°	12-2-Temp. 120° Ordered 2500 gals. to be
11					1:30 PM	1:37 PM	600													90		12:30 PM						61°	190°	delivered at 7:00 Wednesday-3-7-45 BW
12					1:45 PM	1:55 PM	600													92	12:45 PM								60°	190°	1 pt. of Sludgeoil put in #2 Fuel Oil Tank BW
1					1:55 PM	2:00 PM	600			#1-#4										92									62°	190°	Flushed Feed water Heater BW
2					2:15 PM	2:22 PM	600					#1-#2								92									57°	190°	Oil checked in Pumps & Compressors GL
3					2:15 PM	2:21 PM	600				#1									92									49°	190°	Low Pressure Test Clear at 4:30 PM GL
4					2:27 PM	2:31 PM	600									224° DW (Blow) Down				95		5:00 PM							47°	190°	Vento Test off at 5:00 PM GL
5					4:01 PM	5:13 PM	600													95									44°	190°	Flushed Blowdown Feed-water Heater GL
6 p.m.					5:32 PM	5:37 PM	600													100									42°	190°	Blowdown High Pressure Air Tank GL
7					6:02 PM	6:15 PM	600													96									39°	190°	Oil checked in Pumps & Compressors GL
8					6:45 PM	6:53 PM	600				#1									95									36°	190°	High Pressure Test down at 10:30 PM GL
9					7:03 PM	7:23 PM	600													95									38°	190°	Flushed & Blow down Feed water Heater GL
10					7:23 PM	8:00 PM	600													100				11:30 PM	11:38 PM				40°	190°	Wiped up Compressor & floor from oil GL
11					8:28 PM	8:31 PM	600									222° DW (Blow) Down				85						1:30 AM			28°	190°	Changed over from 75 H.P. Compressor to
12					9:23 PM	9:45 PM	600													85									36°	190°	Portable Compressor at 11:00 PM GL
1 a.m.					10:18 PM	10:15 PM	600				#1									Portable Compressor									33°	190°	Cleaned oil burners on #1 Boiler GL
2																				"									24°	190°	Started up #4 Boiler at 5:00 AM GL
3																													36°	190°	Oiled up the equipment GL
4																												76°	33°	190°	
5																															

Water Meter Readings — Meter No. 1: 0562600 — Meter No. 2: 9883200

Soot Blowers On #1 Boiler GL

Remarks:

HOT WATER HEAT ON	HOT WATER HEAT OFF	EXHAUST STEAM PRESSURE ON	EXHAUST STEAM PRESSURE OFF
✓		✓	

ENGINEERS ON DUTY — Signed	HOURS	TIME ON	TIME OFF
George Elliott	9	5:30 AM	2:30 PM
David Wilson	8	6:30 AM	2:30 PM
George Chapple	8	2:30 PM	10:30 PM
George Litchfy	8	10:30 PM	6:30 AM

Three Ways to Control Boiler-Fan Loading

Few forced- and induced-draft fans operate at maximum design conditions continuously. Hence, although fan sizing must be based on maximum anticipated load, normal loads call for means of reducing the delivery, as herein explained

By SIGURD JOHNSON
Buffalo Forge Company

► IN POWER-PLANT FANS it is essential that air and gas flows be regulated to suit the needs of part-load operation. The three basic methods of reducing the output of mechanical-draft fans are as follows: (1) damper control (2) variable inlet-vane control and (3) change of fan speed.

Fan-delivery control by louver dampers is by far the simplest and most economical method in light of initial cost, but it consumes more power than either of the other methods. However, it does permit use of constant-speed motors. This advantage allows the application of the squirrel-cage induction motor, which is the simplest, most rugged and most generally used of all induction motors and can be relied upon for continuous operation. It maintains good efficiency over a wide range of operating loads and can be thrown directly across the line without expensive control and starting equipment.

Louver dampers may be placed at the fan discharge, at the fan entrance, or even beyond the fan in the duct work or breeching. In forced-draft fans, the louvers are commonly placed at the fan outlet, as in Fig. 1. In induced-draft fans, the dampers are placed either at the fan outlet or at the entrance to inlet boxes. Latter arrangement is preferred for induced-draft fans handling hot, dust-laden gas, which would blow out around damper bearings at the fan discharge. If throttling is done on the suction side of the fan, there is always an inward cold-air leakage around the damper bearings. This eliminates the need of some type of stuffing box, between damper frame and bearing housing, which must be used if the dampers are placed at the outlet of induced-draft fans.

Dampers Throttle Flow

Dampers do not change the fan-characteristic-performance curves but simply throttle fan capacity and horsepower along these curves. Fig. 3 shows how reduced ratings on one fan are obtained by damper control. Maximum design requirements of this fan are 40,000 cfm of air at 100 F against a resistance of 11 in. of water. These are met when the fan operates at a speed of 1770 rpm and consumes 98 hp.

Assume the system characteristic changes and the fan is required to deliver 30,000 cfm against 8-in. static pressure. With wide-open dampers the fan would deliver 36,600 cfm at 11.9 in., as at intersection of fan characteristic curve with new system characteristic curve. By partly closing the dampers air flow could be reduced to 30,000 cfm but the static pressure ahead of the damper would be 13.3 in., and beyond the damper 8 in. The damper wastes the difference of 5.3-in. static pressure and the fan consumes 94 hp.

If it were possible to decrease the fan speed so that it would exactly deliver 30,000 cfm at 8-in. static pressure at its outlet, the new speed would be (30,000/36,600) $\times$ 1770 rpm, or 1450 rpm, since fan capacity varies directly as the rpm

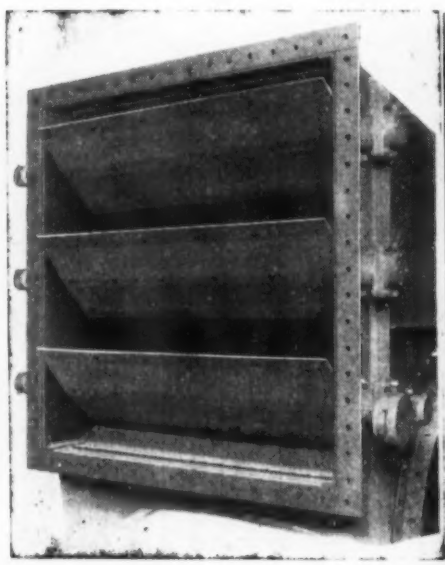


Fig. 1—Multi-blade louver dampers in the fan outlet are used because of the smaller operating torque required, as compared to the single-blade dampers

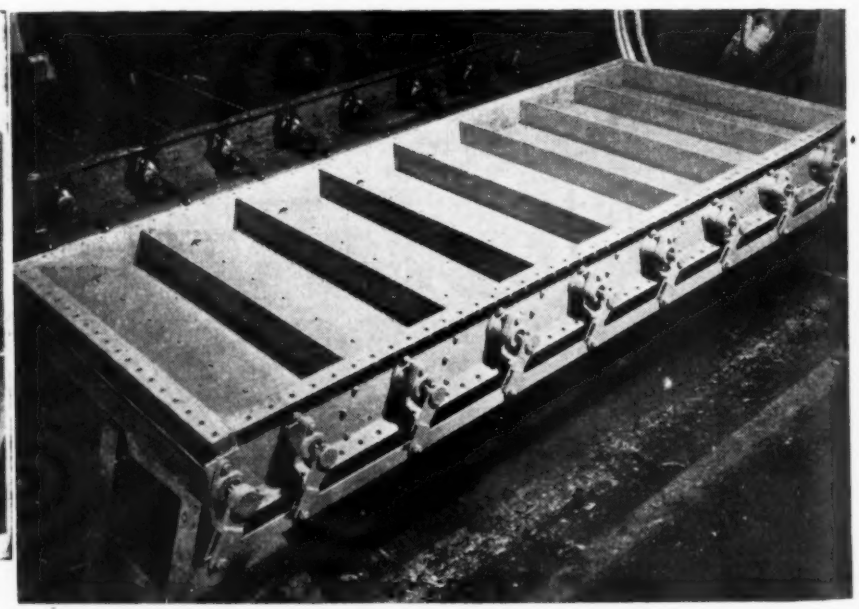


Fig. 2—Flow regulation characteristic of the louver damper (shown in the closed position) is improved by the stationary splitter plates between blades

and the static pressure varies as the rpm squared. Since the fan horsepower varies as the rpm cubed, the fan would consume only 54 hp at the reduced speed without the use of dampers. The large energy dissipation by the damper becomes apparent. In all cases of pure damper control, the fan itself always delivers the static pressure indicated by the fan characteristic curve; the damper simply wastes the difference in pressure between that curve and the pressure desired.

Most damper sections are made up of a series of individual louvers as shown in Fig. 1. Each blade is mechanically balanced and pivoted on a shaft at its center. All blades are tied together with a common linkage. Dampers should have good regulating characteristics; for a given rotation of damper blade the rate of air-flow change should be about the same over the full 90-deg swing. Manual and automatic regulation is made difficult by some dampers that produce a very large change in flow for small movement of blades at small degrees of opening.

Single-blade dampers give better flow regulation than the multiple-blade type but they are not practical for power plants because of the large sizes involved. A large single-leaf damper is difficult to operate because of the great torque required. To reduce this torque to practical values damper sections are built up of several individual blades. Splitter plates between blades of the damper, Fig. 2, improve the flow characteristic; in fact, the resulting regulation is practically as good as a single-leaf damper.

One other method of achieving good regulation uses dampers of opposed rotation wherein each leaf rotates in an opposite direction to the adjacent leaf. The external linkage is more complicated in order that the blades close properly.

Special Damper Balancing

In special cases where damper torque runs excessively high for even multiple leaf dampers of the mechanically balanced type, it is sometimes necessary to resort to a *pneumatically balanced* damper in which the blades are pivoted closer to one edge than the other. This type requires less and more uniform torque for its operation. It is difficult to design such dampers properly because of the unpredictable pressures over the blade faces.

A second method of varying output of mechanical-draft fans driven at constant speed uses variable-inlet vanes. They are radial dampers installed at the fan inlet, Fig. 4, which impart an initial whirl to air entering the impeller. This whirl is given in the direction of wheel rotation and ultimately causes a decreased air volume and pressure developed while the fan consumes less horsepower. Over-all fan efficiency drops as a result of this throttling, but as a means of volume control it is considerably more efficient than louver dampering. Vane control is a simple means of draft regulation, and easily adaptable to automatic combustion control. However, variable-inlet vanes present an additional problem with induced-draft fans because of wear and abrasion.

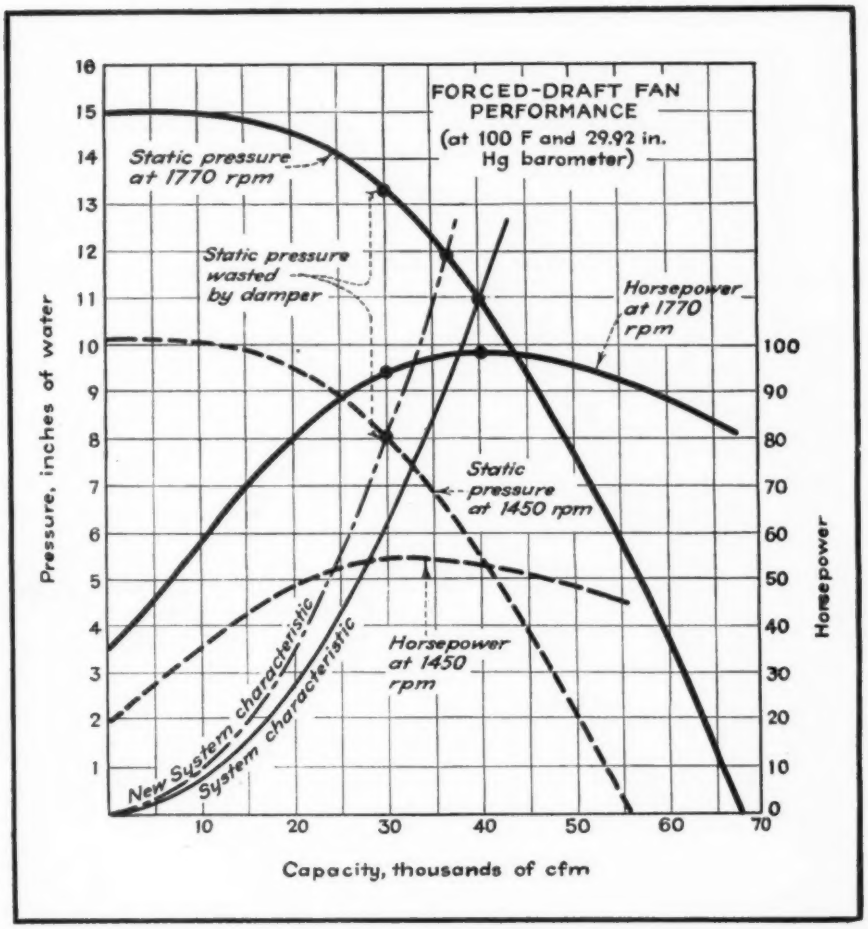


Fig. 3—A comparison of the fan characteristics at two different speeds indicates a waste of energy caused by dampering instead of using fan-speed control

Fig. 5 shows how fan horsepower is reduced with variable-inlet vanes. Static-pressure curve *1* and horsepower curve *1* are obtained when the vanes are wide open. When the fan is operating at point *A* on the pressure curve the corresponding horsepower is at point *B*. When it is desirable to operate at reduced flow without changing the system characteristic, partial closing of the vanes produces new static-pressure curve *2* and corresponding horsepower curve *2* for a given degree of vane opening. Fan operation then occurs at the intersection of the system characteristic and the new static-pressure curve *2* at point *C*. Fan horsepower required is that at point *D*.

For any other degree of vane opening the static pressure produced by the fan lies somewhere on the system characteristic curve and the horsepower on curve *BDE*. Thus, the variable-vane horsepower curve represents the various values of fan horsepower for various degrees of vane opening when the fan operates on a fixed system characteristic.

The third method of fan-delivery control, variable-speed drive, is the most efficient. Because fan horsepower varies as the cube of the speed, it is advantageous to operate the fan at a speed no higher than that required to produce the exact air and pressure requirements of the system. For a given system the point of rating on the fan-characteristic curve does not change with change of speed and therefore fan efficiency remains a maximum with variable-speed control.

Not only energy but maintenance of the fan rotor is saved by operating at minimum required speed. This is par-

ticularly true of induced-draft fans where flue gas contains abrasive material and the fan rotor is subjected to severe erosion. The rate of fan-wheel erosion varies as some power of the air velocity. If the velocity is reduced by variable speed as compared to the high velocities still present in the dampering method, the life of the rotor will be greatly increased.

Direct-current motors provide variable-speed operation but they are little used in practice. Variable-speed turbines offer another means of changing fan speed and are often used as power-plant drives. At times they are utilized in a form of dual drive, with the turbine on one end of the shaft driving at normal and partial loads, and a higher-speed motor at the other end driving at peak boiler demands. Because one drive idles while the other runs, considerable economy in operating costs results despite the windage losses.

In the great majority of steam power plants, however, alternating current is the source of power available for driving the mechanical draft fans. Variable speed is obtained either by a wound-rotor motor or 2-speed 2-winding motors. Wound-rotor or slipring motors have the disadvantage of giving but small speed reduction at the expense of reduced efficiency. Furthermore, the speed changes are in a fixed number of steps rather than in an infinite series, and it is still necessary to use damper control between steps. Starting characteristics of the wound-rotor induction motor are better than those of a squirrel-cage motor but running characteristics are poorer. Expensive resistance controllers are required for changing the speed.

Two-speed 2-winding motors or two single-speed motors, one on either end of the fan shaft, provide but two fixed speeds at which power economy is realized, and then only if the actual operating conditions happen to coincide with these two speeds. Often these speeds are awkwardly spaced, and dampers must handle control between them. With a combination of 2-speed and damper operation the automatic control system becomes quite complicated and hunting is liable to occur.

Constant-speed motors may be used to drive fans at variable speed through either hydraulic or magnetic couplings. The former consists of an impeller coupled to the prime mover, a runner coupled to the driven fan, and a quantity of oil in the working circuit. Torque is transmitted by the kinetic energy given up by the oil as it passes from impeller to runner and back again.

Speed Changes Efficiency

Variable speed is obtained by varying the amount of oil in the fluid circuit and rpm can be reduced to about 20% of full load value. At top speed there is a slip of about 1½ to 3% between runner and impeller. Fan speed selected must be less than full-load motor speed by this amount of slip. At this point the coupling efficiency is at a maximum, amounting to 95 to 97%. At reduced speeds the coupling efficiency falls off to values that are roughly 2% less than the ratio of fan speed to full-load motor speed.

Fig. 6 shows variable-speed curves of a typical induced-draft fan. Curves labeled *Fan horsepower* and *Horsepower input to coupling* give an indication of how coupling efficiencies decrease with fan speed. For example, if it is desired to drive the fan at 800 rpm by a motor whose full-load speed is 1180 rpm, the coupling efficiency would be roughly (800/1180) — 2% or 65.9%. Actual fan brake horsepower at 800 rpm is 152 hp, and therefore horsepower input to the coupling would be 152/0.659, which equals 231 hp.

Variable-Speed Advantages

Some of the advantages of the hydraulic coupling are that it (1) shows a marked power saving over damper or variable-vane control (2) provides a method of stepless control (3) gives a range of control down to 20% of full-load speed as compared to about 50% speed reduction with a slipring motor. It has the disadvantages of being rather slow acting and not very sensitive to changes of load.

Electromagnetic couplings operate on the same slip-loss principle as hydraulic couplings. They consist of two windings wherein torque is transmitted from one to the other by electromagnetic

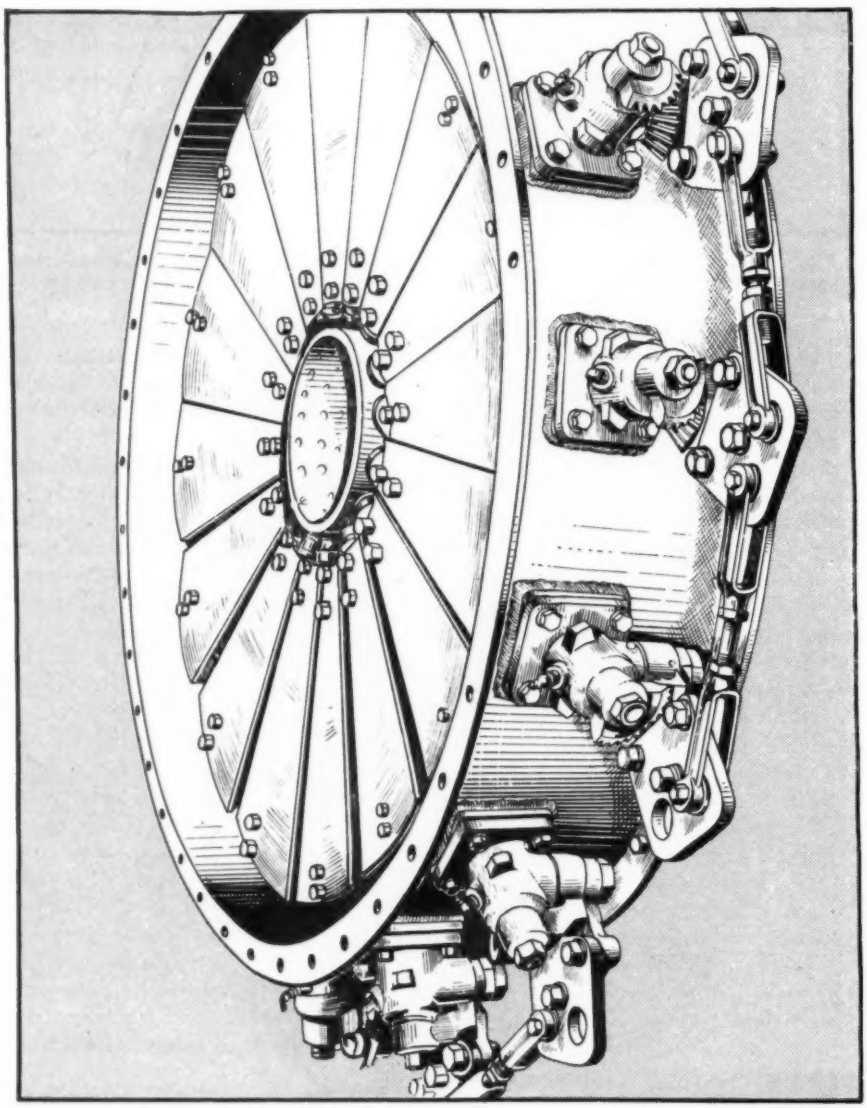


Fig. 4—Fan delivery can be controlled by adjustable inlet vanes mounted on the casing inlet with less energy loss than by dampering on the outlet side

fields and speed control is obtained by varying the field strength. The outer member rotates at motor speed; the speed of the inner member depends on the control current and the torque required by the fan.

Magnetic-coupling and hydraulic-coupling efficiencies run about alike and the same advantages hold for both types. In addition, the magnetic coupling responds much more quickly to changes of load to give exceptionally close and minute speed control. Inasmuch as variable-speed couplings allow the fan to start at practically no load, they permit the application of synchronous motors, desirable for their high efficiency and high power factor.

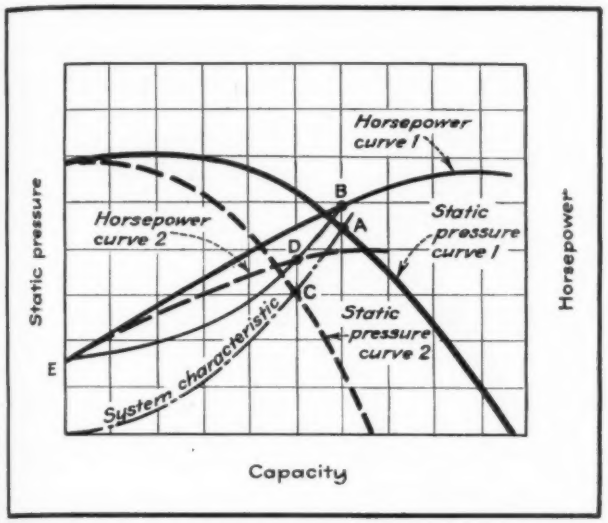


Fig. 5—Adjusting inlet vanes alters fan static pressure and horsepower curves with some energy-input saving

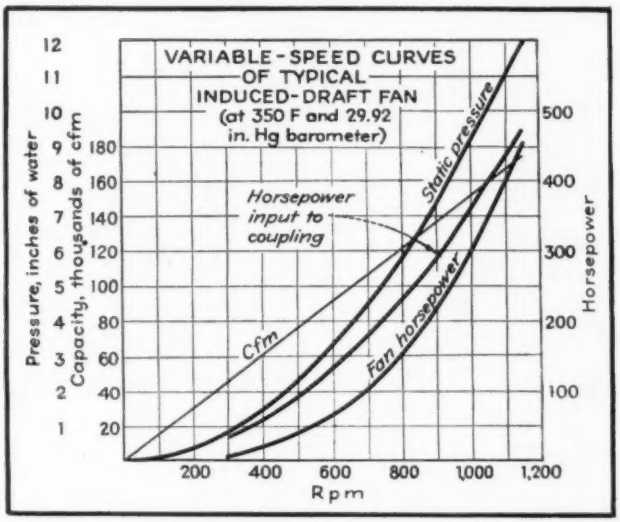


Fig. 6—Variable-speed-fan curves show increasing efficiency of variable-speed-coupling drive with increasing rpm

The Outlook for Atomic Power Plants

By PHILIP W SWAIN, *Editor*

▶LAST MONTH all McGraw-Hill publications, including POWER, carried a special 8-page insert, "The Atom—New Source of Energy." Certain facts and conclusions in that report should be amplified for the benefit of engineers primarily concerned with atomic energy as a possible future competitor of coal for steam generation.

Any analysis must start with these facts: (1) In energy value one pound of Uranium 235 equals 1500 tons of coal. (2) 140 parts of natural uranium contain one part of U-235 mixed with 139 parts of inert U-238, which acts much as ash in coal. (3) It follows that one pound of natural uranium equals about ten tons of coal in energy value. (4) Steam can be produced directly by passing feedwater into a suitable "pile" containing uranium and graphite in alternate layers. In such a pile the U-235 "burns" (disintegrates) spontaneously and at a controllable rate.

To compare uranium with coal as a "fuel" one must consider steam-generator efficiencies as well as heat values. For example, if the pile using natural uranium had an efficiency of only 8%, say, while that of the boiler was 80%, the true coal equivalent of one pound of natural uranium would be one ton of coal instead of ten. Since the actual efficiency of a natural-uranium pile is very much less than 8%, and since this pile requires a purified uranium costing more per pound than coal costs per ton, the natural-uranium pile would be unsuitable for commercial steam generation even if it could be operated at commercial steam temperatures.

At the other extreme, a pile using U-235 would be compact, efficient and operable at high temperatures, and could therefore compete with five-dollar coal *if* the U-235 were obtainable at $7500 per pound. The trouble with this idea is that the present cost of U-235 is many times $7500, with no assurance that it will ever be brought down to that level—certainly not for many years.

As usual, then, the engineer must look for some optimum concentration of U-235—something much less than 100% but substantially more than 0.7% in natural uranium.

Even a moderate rise from this 0.7% greatly improves pile efficiency, by more complete use of U-235, and also permits a much less cumbersome pile. The best combination of pile efficiency and "fuel" price will probably be found with a U-235 concentration somewhere between 1% and 15%.

Yet even this most economical uranium steam generator will not compete with coal for many years. This prediction is based entirely on the tremendous cost of separating the U-235 from a much greater mass of the chemically identical U-238.

The price of the raw material—natural uranium—will be relatively unimportant unless it rises far above prewar levels. This, of course, is a possibility. Also possible, even probable, are controlling government restrictions on atomic power sources and applications.

Although atomic energy cannot replace normal coal uses for many years, certain specialized and limited heat applications in competition with electrical heat and premium fluid fuels may arrive within ten years.

Capture of German U-Boat Reveals Diesel Details

By making a prize of the U-505, a feat virtually unheard of in modern warfare, the Navy got its first chance to learn directly engineering features of enemy subs. G H Menefee, USNR, in charge of engine overhaul, describes a main diesel

In a historic action on June 4, 1944, a Navy escort-carrier task group attacked, boarded, captured and started on the trip back to the U. S. the U-boat 505, marking the first time in U. S. history since 1815 that a foreign enemy man-of-war was boarded and captured in battle on the high seas. The group was headed by the escort carrier *USS Guadalcanal*, under command of Captain Daniel V Gallery, USN. The capture of the 505 was held secret in order to keep from the Nazi high command the fact that we had one of their undersea boats to examine for technical and operational information. While not of the original boarding party, the author of this article was in charge of overhaul work on a main engine and describes its construction features from first-hand experience—*Ed.*

► THE ENGINE DESCRIBED in this article was built by MAN at Augsburg in 1940 and installed in the submarine in 1941. It is a 9-cyl 4-cycle single-acting 15.75x 23.6-in. supercharged engine developing a normal output of 2200 hp at 470 rpm. The maximum rating, at 490 rpm, is 2500 hp. Table I, facing page, gives general dimensions and characteristics.

A cast-steel box frame, with aluminum oil pan, supports a cast-steel cylinder block, with individual cylinder heads. All castings are of one-piece design. Steel main-bearing caps are doweled into frame cross members and are supported by through bolts running from the bottom of the lower bearing caps to the top of the cylinder block. Poured babbitt lines the shells; shims adjust clearance. Jack bolts inserted between frame and bearing caps hold the bearing-top halves. Access doors, secured by wing clamps, are provided on both sides of the engine opposite each crank.

Cylinder liners are of conventional form, inserted in the block and held in place by the cylinder heads. Dowels prevent liners from turning, keeping valve recesses in the top from shifting.

Each cylinder head carries its own rocker-arm assembly, forming a complete unit with the exception of a shaft through all rocker arms, used in changing engine rotation. No cover is provided for any engine working parts except over the camshaft and crankcase.

The crankshaft is hollow in both crankpins and journals; openings at each end are sealed by cover plates held by a through bolt, Fig. 1. Drilled holes in the crankwebs provide for lubricat

ing-oil flow. The T-foot connecting rod carries an eye in the small end for the wristpin bushing. The rods, H-shaped in cross-section, are drilled for wristpin lubrication. The hollow-steel pin, fixed in the piston, is sealed at each end by tapered steel plugs joined by a through bolt.

The crown of the aluminum trunk piston bolts to the skirt just above the wristpin bosses. The crown carries six compression rings and one oil-control ring, with an additional one in the skirt immediately under the pin boss.

Four valves, all caged, serve each cylinder; exhaust valves are cored to provide for cooling water. The valves stand symmetrically around the spray valve, which is in the center of the head. A single pushrod serves each pair of valves and the arrangement necessitated by the valve locations is rather unusual, Fig. 2.

Grease cups mounted on the rocker-arm bridges lubricate the rocker bushings. Instead of a guide of the usual type, the valve cages contain a short nipple pressed into each end of the cage and doweled in place. The valve-spring retainer consists of a split clamp with a bolt to hold it tight around the stem. The retainer also bolts to the keeper over the spring.

A pilot valve mounted at the engine front actuates the balanced-piston air-starting valves, contained in cages to facilitate repairs. Six of the nine cylinders receive starting air.

Gear driven from the crankshaft, the camshaft mounts in a recess on the engine's inboard side. To reverse the engine, an air cylinder shifts the camshaft so that a different set of cams come under the push rods. As the camshaft moves, a linkage holds the pushrods up, out of the way of the cams. The rocker arms are mounted on an eccentric which moves through one full turn as the reverse gear operates. This lifts the rocker arms off the valve stems and replaces them when the pushrods are lowered on the new set of cams, preventing the rocker arms from forcing a valve down on the piston when the pushrods are raised.

The injection system, of Bosch design, differs from American Bosch systems in two main respects. In the fuel pump, which is of the individual type, there is a linkage by means of which the cam followers may be moved, thus changing injection timing. Circulation of fuel oil under low pressure cools the injector; oil supply comes from the fuel-transfer pump. The injector differs from the conventional nozzle in that the orifices are in the spray-tip retaining nut rather than in the spray tip. There is a ground joint where the two seat together. The transfer pump supplies fuel at about 10 psi and injection pressure is 3675 psi. The petroleum oil used for fuel is similar in most respects to that used in our engines.

Since several of these submarine engines are now in our hands, additional data may soon be released on their construction and performance. However, this brief description should give the reader an idea of the general design and outstanding peculiarities of this diesel. Primary objective in design of this unit seems to have been substitution of speedy fabrication for finished workmanship and the saving of as much metal as possible by departures from what might be considered standard practice.

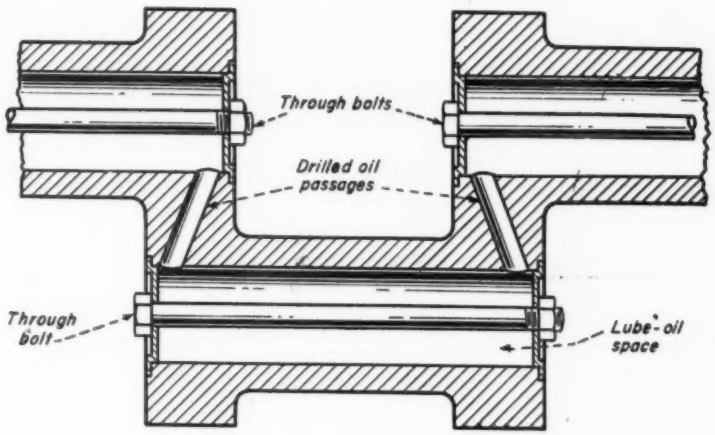


Fig. 1—Crankshaft is hollow in crankpins and journals; openings at ends are sealed by cover plates held by through bolts

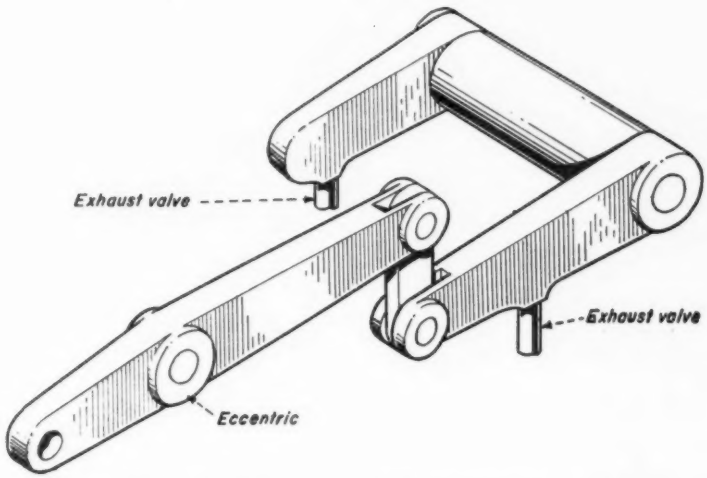


Fig. 2—When unit reverses, eccentric moves through full turn, lifting rocker arms off valve stems and replacing them when pushrods are lowered on new set of cams, keeping rocker arms from forcing a valve down on piston when pushrods are raised

TABLE I—ENGINE DATA

Normal horsepower, 470 rpm	2200
Maximum horsepower, 490 rpm	2500
Cylinder dimensions	15.75x23.6
Engine weight, dry, lb	54,780
Firing order, RH	1-3-5-7-9-8-6-4-2
Compression pressure, psi	588
Firing pressure, psi	882
Compression ratio	14.4-1
Maximum torque, ftlb	24,299
Bmep at 2200 hp, psi	115
Bmep at 2500 hp, psi	125
Blower type	Buechi exhaust-driven
Blower speed, rpm	10,900
Maximum temperature at blower, F	1040
Pressures:	
Cooling water, psi	10-15
Lubricating oil, psi	10-30
Starting air, psi	900-1100
Reversing air, psi	50-75
Injection, psi	3675

What Power Engineers Should Know About Coal Crushers and Crushing

Wilbur G Hudson, materials-handling consulting engineer, draws on his long experience with coal-handling installations to give power-plant engineers useful pointers on crushers: what they can and cannot do, and the equipment best suited to the coal-preparation job of a given steam-generating plant

▶ THE COAL-HANDLING SYSTEM of a steam plant requires a crusher to reduce lumps to suitable dimensions for stokers or pulverizers, particularly for mine-run coal. However, sized coal taken from cars or outside storage may be frozen or lumpy, and may contain tramp iron, nonmagnetic metal fragments, sulphur balls, planks, rags and large wads of straw. A crusher breaks up the coal lumps, and some types remove foreign matter. There are several designs and sizes to suit different plant needs.

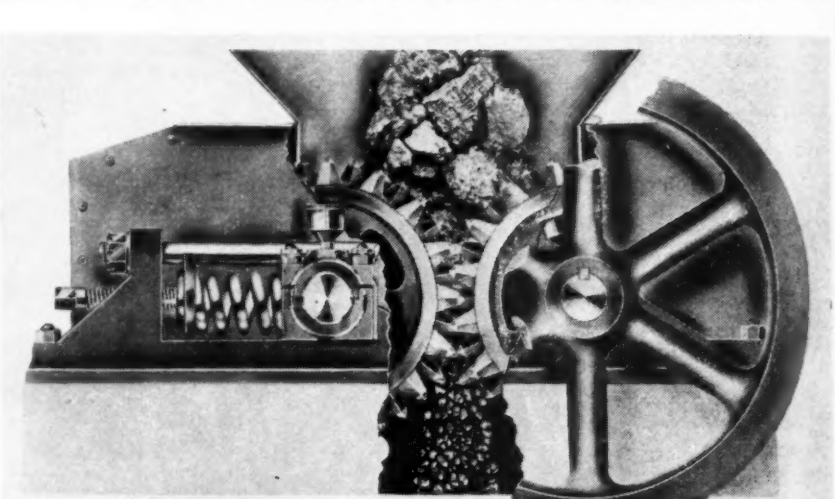
Double- and single-roll design. About 40 years ago conveyor manufacturers developed the 2-roll crusher and, a few years later, the single-roll design. To protect the 2-roll crusher against smashup by unbreakable lumps, one of its shafts is supported in bearings backed by heavy helical springs, Fig. 1. In the single-roll crusher this protection is provided by a shearing piece or springs that hold the breaker plate in position. The springs, as in Fig. 2, have the advantage that the breaker plate is quickly reset after an unbreakable lump passes so that few oversized pieces slip through.

Crusher Adjustment

Changing coal size. Doing this while the crusher operates is an advantage, particularly in coal-preparation plants where size changes are frequent. Impracticable in older designs of the 2-roll crusher, this is easily accomplished in the single-roll crusher by adjusting the breaker plate. Modern designs of the 2-roll crusher, Fig. 3, permit size adjustment during operation. In this unit, the motor-driven roll-adjusting mechanism is on its front end. Performance of double- and single-roll crushers shows little difference. The double-roll design performs better on large lumps, as the 2-roll gripping action is prompter than that of the single roll's long slugger teeth. A single-roll crusher sometimes falters under a succession of lumps, and chokes as coal feed continues.

Reducing large lumps. Attempts to enable a roll crusher to receive and reduce large lumps to small size include a 3-roll machine with two rolls widely spaced for primary crushing, and the third set close for final reduction. In a 4-roll machine, upper pair of rolls is widely spaced whereas lower pair is close together. Neither of these designs is favored because their drive is rather complicated, adjustments are inconvenient, and they require about twice the headroom of a hammer mill.

Limit of coal-size reduction. For roll crushers the limit usually is from dust up to 1-in. lumps. It is possible with a 2-roll crusher to reduce lumps to ¾ or even to ½ in. by using small teeth



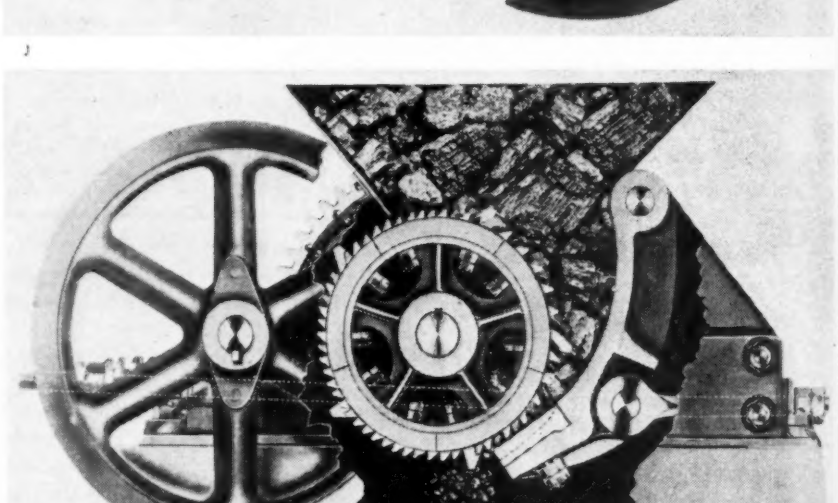


Fig. 1, top—Relief springs and floating bearings of 2-roll crusher permit one roll to yield for passing hard foreign substances. Fig. 2, bottom—To protect this one-roll crusher, its adjustable breaker-plate rods have relief springs

or flutes on the rolls, but with considerable loss in roll-gripping power. I recall a 36x36-in. crusher with finely fluted rolls, one revolving at twice the speed of the other to provide a tearing action, which operated satisfactorily when producing ½-in. lumps. Quite some oversized ones passed through because of momentary spring yielding.

Fine Crushing

Hammer mills. For fine crushing a hammer mill, Fig. 4, is desirable. This unit has a single high-speed rotor equipped with pivoted hammers, of varying shape according to the manufacturer's preference (triangular, bar-shaped, ringed, etc), which shatter and grind the lumps through the grid spanning the discharge opening. Spacing of the bars determines maximum size of product. In a hammer mill any material too hard to crack up is thrown off centrifugally into a trap, and the hammers' action grinds up straw, rags, etc, which would either pass through or stall a roll crusher.

Bradford breaker. Where the reduction need not be below ¾ in., a Bradford breaker may be preferred. This rugged slow-speed machine (25 rpm or less), with perforated cylinder having internal baffles or lifting shelves, takes coal in at one end. It repeatedly lifts and drops the lumps while fines screen out and unbreakable lumps (frozen clay, tramp iron, nonmagnetic metals, rags, etc) pass out at the other end. A reduction to about 1 in. by zero is the usual duty of this machine with standard capacities up to 600 tons per hour. Power requirement is comparatively low, but cost is more than for a roll crusher or hammer mill and space requirement greater. A recently developed breaker design has a modified hammer mill within its cylinder, which substantially increases the capacity and saves hard lumps that might not crack up by tumbling alone, Fig. 5.

This breaker is best suited to a large installation where the unit is, for example, 10x17 ft with 350-tons-per-hr capacity of New River mine-run coal to 1¼-in. ring size, with 75% of ¾-in. ring size, or under. Separate motors drive breaker and hammer mill. Because it is not necessary for the hammer mill to run all the time during breaker operation, its motor is not interlocked with the coal-handling system.

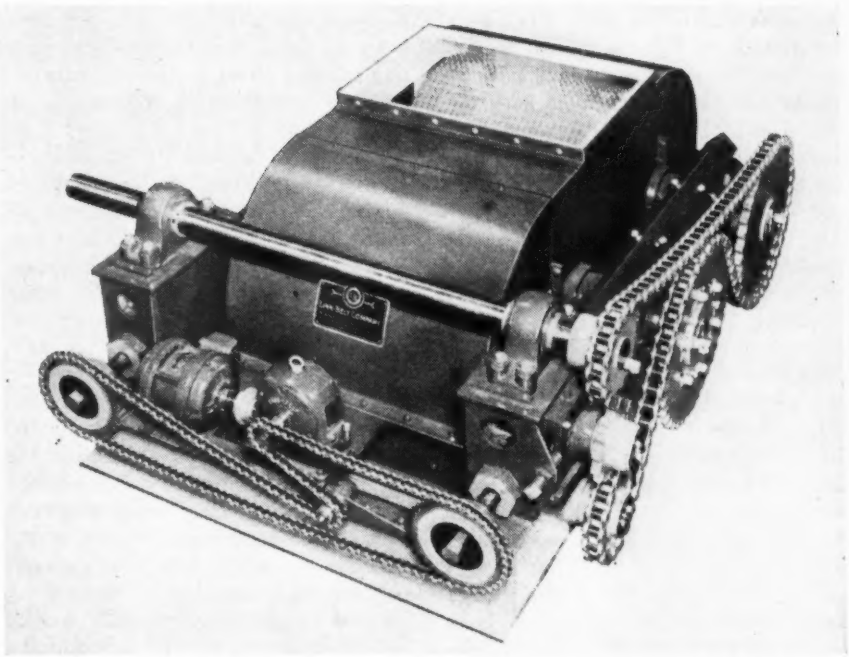


Fig. 3—Chain-driven 2-roll coal-sizer with motor-driven mechanism for adjusting position of one roll to change crushed-coal size when crusher is in operation

Selecting crusher for specified capacity. Certain factors must be taken into consideration. Incoming coal may range from dust or undersized up to large lumps. Often it is possible to screen out and bypass the undersized, sending through the crusher only material that needs crushing. Manufacturers' tables give the largest lumps each size of crusher digests, which may lead to a needlessly large crusher if the largest lump is the exceptional one. Often it is possible without undue hardship to break the exceptional lump on a grizzly ahead of the crusher.

Rating of crusher. Its capacity rating assumes that none of the undersized coal has been screened out. If it is screened out, the crusher required must have a rated capacity equal to the tonnage screened out, plus that to be crushed. For example, if 140 tons per hr of hard bituminous coal is to be handled and we are going to screen out 50% of it as undersized, only 70 tons of lumps remain to be crushed. However, we still require a crusher, rated 140 tons per hr, of the kind of coal to be crushed. Here rated capacity is 140 tons per hr. but because of screening out the fines working capacity is only 70 tons per hr.

Purchaser's specifications. The purchaser must specify what coal he intends to use. If possible he should send a liberal sample—even a carload—to

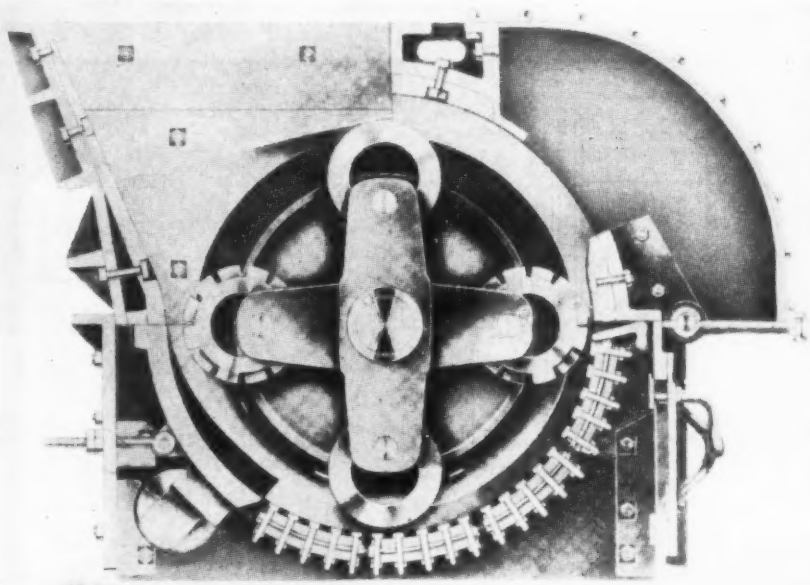


Fig. 4—Hammer mill has a single high-speed rotor equipped with pivoted hammers. Material too hard to be crushed is thrown off into a trap on the right

the manufacturer for tests. Some coals are quite hard (W. Va. Splint, Indiana Block, Illinois, Iowa, Pennsylvania, Freeport). Some are medium hard (W. Va. Thacker, Panther, Banner, Kentucky, Harlan, Ohio Hocking). Some are quite soft (Pocahontas, New River, Connellsville, Pittsburgh #7 and #8). Also he must specify whether the crushed-coal lump is ring size (size of ring through which the lump will pass) or square size. There is quite a difference: For example, 2-in. ring size is equivalent to 1.5-in. square, and 5-in. ring equivalent to 4-in. square.

Occasionally the purchaser's specifications call for a product with no lumps larger than a certain ring size. This is not objectionable for a breaker or hammer mill because all the coal passes through a screen or grid, but it is a difficult requirement for a roll crusher because an occasional larger lump passes, either when there are momentary gaps between the teeth or when the release acts to pass a hard piece. Manufacturers usually take exception to such a requirement, maintaining that the machine will reduce the coal so that 85% or 90% will not be larger than the specified size.

When feeder is needed. Crushers cannot control the rate at which coal is fed to them; therefore, unless a conveyor fixes the rate, a feeder is necessary. If feed is continuous rather than intermittent, it improves crusher performance. The old, reliable reciprocating feeder, even though inclined downward 10 or 15 deg as it should be, is wanting in this respect. It discharges as the plate recedes and flow stops as the plate moves forward. Twin reciprocating feeders, interconnected so they discharge alternately, provide more even flow. An apron feeder gives a more continuous flow. Also, it seems to distribute the lumps along the moving mass on the apron.

Mechanical and electromagnetic vibrating feeders have the advantage of serving also to screen out the fines ahead of the crusher. Their feed rate is easily adjusted, and no moving parts require adjustment and lubrication. Whatever the type, a feeder must stop promptly if the crusher stops.

Installation Layouts

Roll crushers and hammer mills. They have a tough job. When making the layout for their installation consider carefully how to make repairs without extensive dismantling. Provide ample clearance space and headroom to maintain the equipment.

Metal fragments from coal. Steam-plant requirements may call for the elimination of metal fragments from coal. A roll crusher must then be provided with a magnetic pulley near its discharge which, however, removes only iron or steel. The Bradford breaker removes magnetic or nonmagnetic metal fragments unless they are small enough to pass through the screen openings, and it also removes large pieces of wood, rags, straw, etc. A hammer mill also traps out metal fragments whether magnetic or nonmagnetic.

Overload relays. A crusher may be protected from jamming by overload relays, which stop its driving motor and that of the feeder or conveyor serving it. A shear pin in the connection between crusher and its motor releases the crusher motor if the former jams, but will not stop the feeder motor, even though it is interlocked electrically.

Change in speed. Bradford breakers are gear or chain driven through suitable speed reduction at the motor. Hammer mills may be direct-connected through flexible coupling, but since it may be desirable to ascertain whether a change in speed improves performance, it is best to drive through a multiple V-belt provided with speed-change sheaves. Roll crushers often have a built-in countershaft providing a speed reduction of four or five to one. To relieve the shock loads connect the drive motor to the crusher's countershaft by a flat or multiple V-belt.

Dustless operation. Modern practice in coal handling requires dustless operation. When a crusher discharges to a bucket elevator direct, a closed connection eliminates dust by chimney action, if the elevator's casing is vented. This is not true of a continuous-flow elevator as its duct is completely filled with material. When the crusher discharges to a skip hoist, flight conveyor, or pivoted-bucket carrier, a closed connection often is impracticable, and a housing should be provided, either with a vent pipe of substantial height or with a small exhaust fan, driven from the conveyor's terminal shaft.

Discharge from the crusher may be to an apron conveyor that feeds an elevator. Such a conveyor seals in the dust, except for a few seconds at the start of a run. A Bradford breaker is always within a housing and does not scatter dust except what may be vented out of the receiving hopper and be readily taken care of. The trend is so strongly toward elimination of all dust that this detail receives much more attention than formerly.

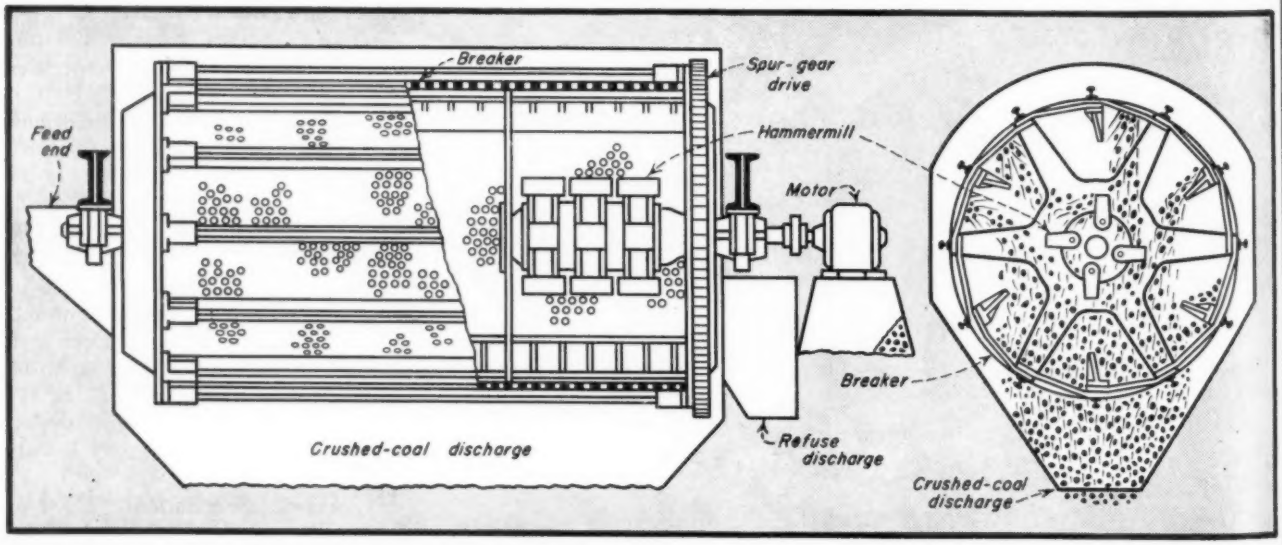


Fig. 5—Breaker and hammer mill, used where large crushing capacity is needed, combines a Bradford breaker and hammer mill in a single unit. It saves hard lumps of coal that might not crack up by tumbling alone in a breaker

Insulated Flange Saves Kilowatts for Pipe Heating

On this construction job an exposed water line had to be heated electrically to avert freezing. A R Gruehr describes the method and tells how insulating one flange saved power

▶ THE GRINNELL MULSIFYRE LINE to the south transformer room at Hell Gate generating station consists of 6-in. standard steel pipe with screwed cast-iron flanges and rubber gaskets. It is connected to the city-water system in a steam-heated meter room east of 134th St boiler-room gate. About 100 ft of pipe were exposed in the construction area, including about 10 ft inside the partition north of the boiler-room basement. Normally no water flows through the pipe but it cannot be emptied because this would defeat the system's automatic protection feature.

Original construction schedule for No. 1 Hell Gate unit assumed that the structural-steel erection would be sufficiently advanced by winter to permit decking over the roof. Therefore the exposed pipe section's only protection against freezing was a double layer of 1-in. hair felt. However, because of unforeseen steel-erection delays, the construction area remained open throughout the winter, and the felt covering alone seemed inadequate.

Heating Rate

A rough calculation indicated that with an assumed ambient-air temperature of 0 F the pipe could be maintained above freezing temperature by supplying it with heat at the rate of about 32 Btu per hr, or 9.4 watts per pipe foot. A temporary electrical installation was made to heat the pipe with low-voltage ac, using a standard 50-kva 2200/220/110-v transformer. Primary side of the transformer was connected to a 220-v circuit through a 2-pole switch fused for 35 amp. Secondary coils were connected in parallel. Lengths of 500,000-circular mil cable were connected to the pipe by iron clamps at points 100 ft apart. An 8- to 12-v lamp across the transformer secondary terminals served as an indicator that the circuit was energized.

Current distribution and leakage were determined by measuring voltage drop across 4 ft of pipe. On first tests, parallel path losses to ground through pipe hangars were negligible, but about 28%, or 105 amp, of the total secondary current of 370 amp went to ground at pipe terminals. To reduce this loss, the circuit to ground was opened in the water-meter room by insulating one pipe flange on the ground side of cable clamp.

Since the flange faces were separated by a rubber gasket, current was carried through the iron bolts. First attempt to insulate the bolts by painting the shank with lacquer and placing mica washers under bolt heads was unsuccessful. The lacquer and mica washers were damaged in tightening the bolts. They were then removed, one by one, and insulated with a layer of silk tape around the shank and a fish-paper washer under the bolt head. This method proved successful, and ground current dropped to a negligible value.

The secondary current supplied to the pipe was about 310 amp at 9 v and power input was 1500 watts, or 15 per pipe ft. Temperature under the pipe covering was 40 F above the ambient air temperature. Readings were taken early in the morning, before the ambient air temperature rose above the approximate average of the preceding night.

Installation required no maintenance, and operated uninterruptedly three months. With electric-energy cost at the generating-station bus about 0.6¢ per kwhr, its operating cost was 22¢ per day, or approximately $7 per month.

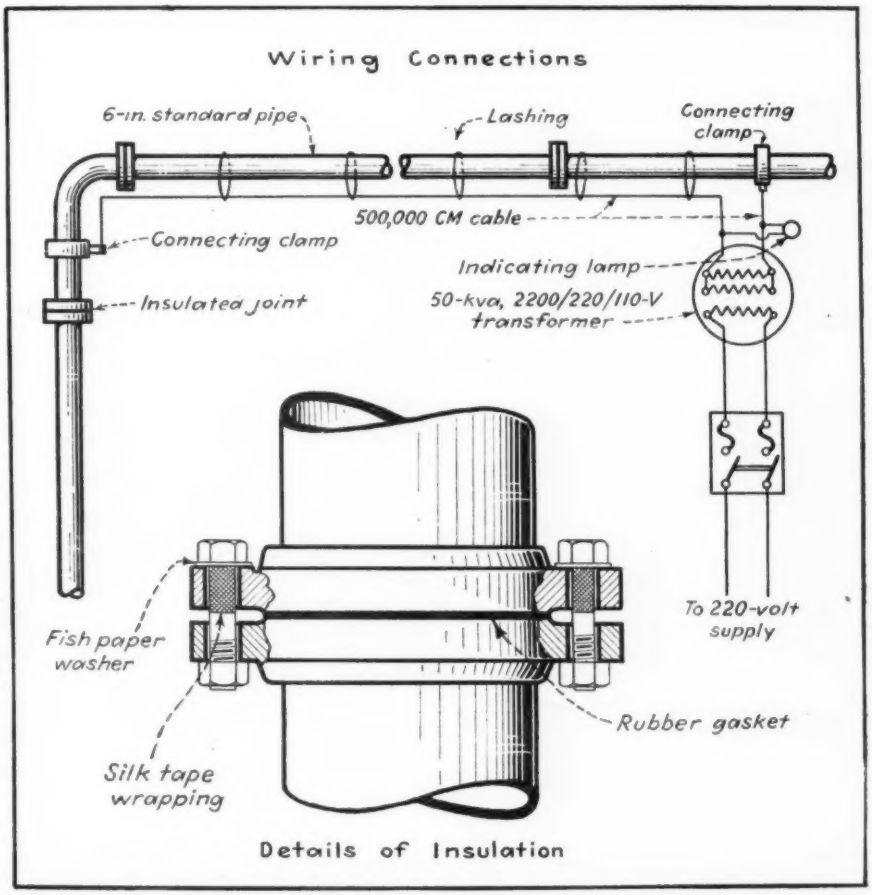


Fig. 1—Cable from the transformer secondary connected to each end of exposed pipe. Flange bolts were insulated with silk tape and fish-paper washers

Standard Nozzles Mean Better

In this second part of an article on standard nozzles for measuring air flow in ejector tests, calibration of nozzles shows close agreement among the same sizes. Also reviewed in this account of the Heat Exchange Institute project is the behavior of fluid flow taking place at critical and supersonic speeds

By HOWARD S BEAN, *National Bureau of Standards*
W H REYNOLDS, *American Instrument Co*
RAWLEIGH M JOHNSON, *Ingersoll-Rand Co*

▶ PART I DESCRIBED the need of providing standard nozzles for measuring air flow in ejector tests. To achieve flow-measurement duplication, the nozzle was considered as a precision instrument and manufacturing methods were accordingly developed. From a group of 24 sets of nozzles manufactured with precision methods, ten sets were selected at random for calibration by the National Bureau of Standards. (For the foregoing, see POWER, September, 1945, page 71.)

To understand some of the problems the Bureau faced in the calibration of standard flow nozzles, it is necessary to review the peculiar physical phenomena associated with *critical flow*. Since they have not been generally discussed, the nature of these phenomena provides a new viewpoint to many interested in fluid-flow problems.

While the term critical-flow nozzle (synonymous with high-pressure nozzle in the ejector industry) is more descriptive of use than of design, the nozzle is always of the converging type, ending at the section of minimum cross-sectional area, or with a short cylindrical section of the same area. In fluid mechanics, the term critical-flow usually means that condition when the velocity of gas or vapor reaches the speed at which sound travels in the gas or vapor at the density and pressure existing at the section where that velocity occurs. Hence, critical-flow describes a nozzle when the velocity at the minimum or throat section reaches the velocity of sound.

This velocity is obtained by increasing the inlet pressure or decreasing the outlet pressure until the ratio of outlet to inlet pressure is decreased to nearly 0.5. The exact value of this critical-pressure ratio depends upon the gas density, the exponent of adiabatic expansion, which for air is very close to the ratio of its two specific heats, and upon the ratio of the nozzle-throat area to that of the inlet channel.

For air at ordinary room conditions, the value of the critical pressure is 0.528 when the area of the approach channel is very large with respect to the nozzle-throat area. The value of the critical-pressure ratio increases as the area ratio increases and as the ratio of specific heats decreases, so that for steam and an area ratio of 0.65 the critical pressure is 0.61.

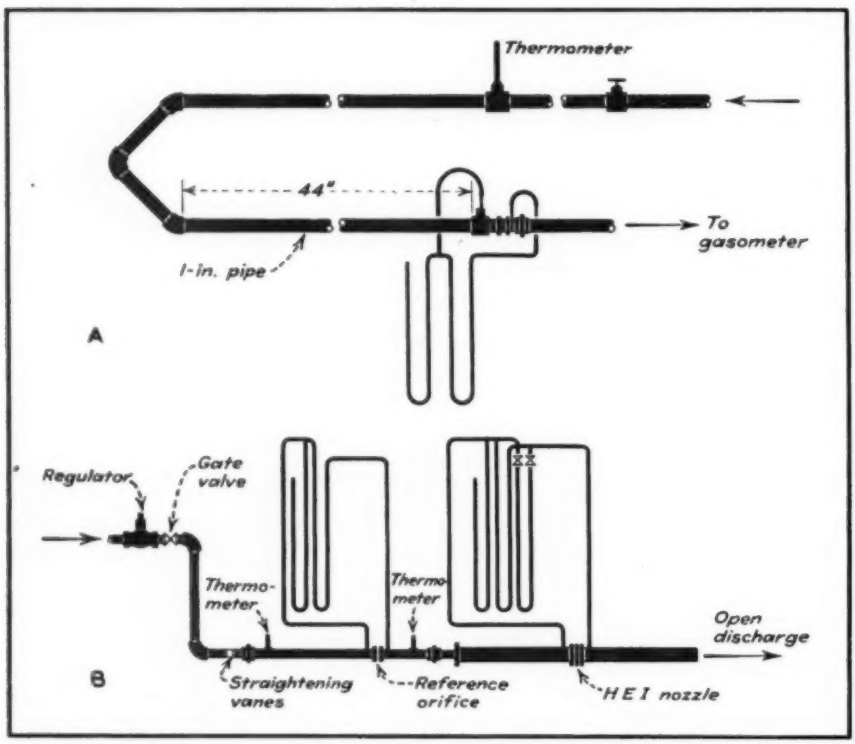


Fig. 9—Arrangement of air piping and measuring instruments used for the calibration of standard flow nozzles, as set up by National Bureau of Standards; A for nozzles of 1/16 to ¼ in. diameter; B for nozzles of 5/16 to 1 in. diameter

Critical-Pressure Flow

Once the critical-pressure ratio has been reached, the jet velocity remains constant even if the pressure ratio is decreased below the critical value. When the critical-pressure ratio is reached by maintaining constant inlet pressure and decreasing the outlet pressure, the jet velocity, volume flow rate, and mass flow rate remain constant for further decreases of the outlet pressure below that corresponding to the critical-pressure ratio.

However, when the critical-pressure ratio is reached by maintaining constant outlet pressure and increasing the inlet pressure, the jet velocity and volume flow rate remain constant after the critical ratio is reached, but mass flow rate increases with the inlet pressure. This follows from increased density of the gas in the nozzle throat. In this particular instance, the seeming discrepancy in the (pressure) energy at the inlet and outlet conditions appears to be ab-

Fluid-Flow Measurements—II

sorbed in the formation of "standing" pressure waves in the jet.

Limitation of jet velocity to that of sound seems to be a characteristic of a nozzle with a well-rounded entrance and a cylindrical throat. Experiments have indicated that, with square-edged orifices and nozzles that have expanding throat sections, jet velocity does not reach a constant value as the critical-pressure ratio is exceeded.

With both of these types of throttling devices, jet velocities well above that of sound may be obtained. However, standing pressure waves are formed in the jet and there is an abrupt change in the relationship between velocity and pressure drop.

While it is impossible to give a simple explanation of the formation of these standing pressure waves and why the jet velocity from a cylindrical-throated nozzle does not exceed the acoustic velocity, the preceding remarks may aid in forming a better mental picture of one of the most important characteristics of HEI nozzles, applied to ejector air-flow tests.

Originally it was proposed to limit the nozzle calibrations to the critical-flow region. At that time, the Bureau of Standards had available facilities with which most of the testing could have been done with weighed water, and it would not have been necessary to make more than a few check tests with air. This procedure was both faster and more accurate than use of air throughout.

However, before any of the nozzles had been delivered, the war changed conditions at the Bureau so that the hydraulic laboratory facilities were no longer available. In the meantime, the HEI committee had decided to extend the range of tests for all but the two smallest nozzles well down into the sub-critical or low-pressure flow region, to obtain more complete information.

The nozzles were divided into two groups: (1) all of ¼-in. throat diameter and smaller (2) those of $\frac{5}{16}$- to 1-in. throat diameter.

Nozzles of the first group were calibrated by measuring the actual volume rate of discharge by a gas-meter prover of 5-cu-ft capacity. Fig. 9, *A* shows the arrangement of the test line and equipment, while Fig. 10 illustrates the method of mounting the nozzles and

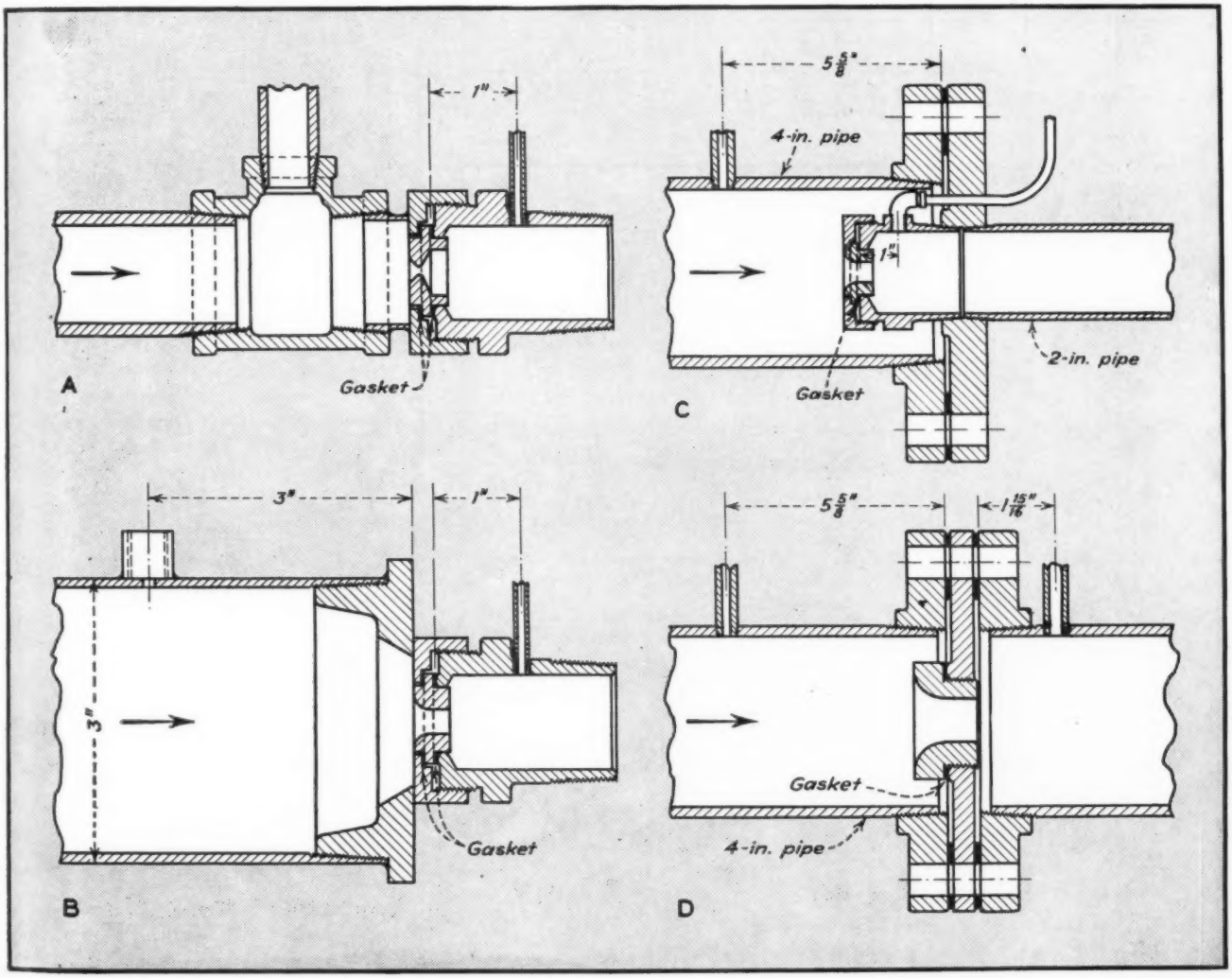


Fig. 10—Detail of standard HEI flow nozzle mountings and pressure-tap arrangements as set up for air-flow calibration by the National Bureau of Standards laboratory; A 1/16 and 3/32 in. B: ⅛ to ¼ in. C: 5/16 to ½ in. D: ¾ and 1 in.

adapters. Rate of filling the prover was obtained from records made on a chronograph, which also recorded half-second signals from a chronometer. Observed data also included the inlet pressure, pressure drop at nozzle, air temperature, barometric pressure and psychrometer readings.

For testing the larger nozzles it was necessary to resort to secondary standards. A set of square-edged orifices, the discharge coefficients of which had been determined by weighed-water tests, was used. In a few cases it was possible to make check tests against flow nozzles, the coefficient curves of which had also been determined by weighed-water tests. Test-line arrangement for these nozzles is shown in Fig. 9. *B*. The reference orifice is on the inlet side of the critical-flow nozzle and the discharge was to atmosphere. When the nozzles are used at flow rates that are below the acoustic velocity, it is recommended that the pressure-tap locations be about as shown in Fig. 10.

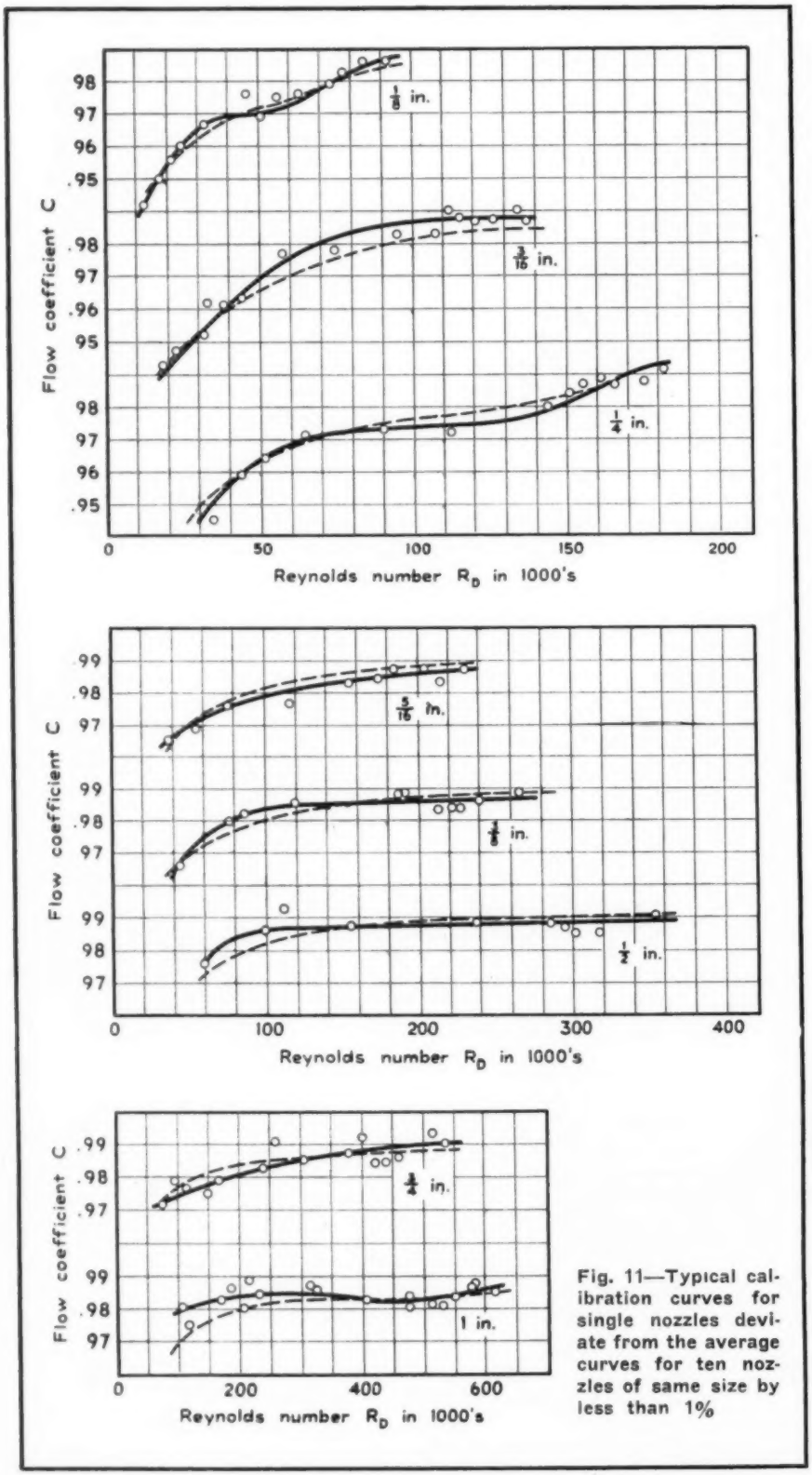


Fig. 11—Typical calibration curves for single nozzles deviate from the average curves for ten nozzles of same size by less than 1%

Fig. 11 shows the test results for eight of the nozzles in the form of curves of discharge coefficient *C* vs fluid Reynolds number at the nozzle throat. For each nozzle the full, heavy curve represents the best smoothed value for the test points obtained. The lighter dotted line represents the average curve for that size nozzle from all ten sets. For any of these nozzles the maximum difference between these two curves is 1%, and the average difference is only about 0.1 to 0.2%. This is representative of the entire group.

Calibration Irregularities

Fig. 12 shows interesting irregularities in some of the test results. The breaks in the heavy lines are in the region of the critical-pressure ratio. To the right of these breaks the curves are distinctly higher than they are to the left. This increase in the value of the discharge coefficient is the same as though the thickness of the boundary layer within the nozzle were decreased, thus increasing the effective cross-sectional area of the jet. Whether or not this is the correct explanation cannot be determined from these few tests but would require more investigation.

This type of "jump" in the coefficient curves was not noticed with any of the nozzles above the ¼-in. size. However, these tests were made against secondary standards and the over-all precision of the individual results is not so high as for those tests made against the gas-meter prover.

Probable Fluid Behavior

The air stream breaking away from the nozzle wall just at the throat-entrance section may have caused the hump near the lower end of the curves for the 3/16- and ¼-in. nozzles. This type of result is not unusual in flow-nozzle testing—a number of similar results were obtained during the flow-nozzle research by the Fluid Meters Research Committee of the ASME. However, there is no satisfactory explanation of why such irregularity is obtained with some nozzles and not with others, particularly when the approach curvature and surface finish were so regular and smooth as with these nozzles.

Flow-nozzle pecularities, as brought out in the foregoing discussion, illustrate some of the problems the physicist faces in his effort to correctly evaluate the third significant figure of the flow coefficient. However, the practical test engineer derives satisfaction from knowing that these speculations do not concern the second significant figure.

In recognition of the wide interest indicated by the many inquiries from the laboratories of institutions and other industries, the Heat Exchange Institute has authorized the American Instrument Co to reproduce these flow nozzles and adapter fittings in strict conformance with HEI standard specifications, drawings and workmanship for public sale.

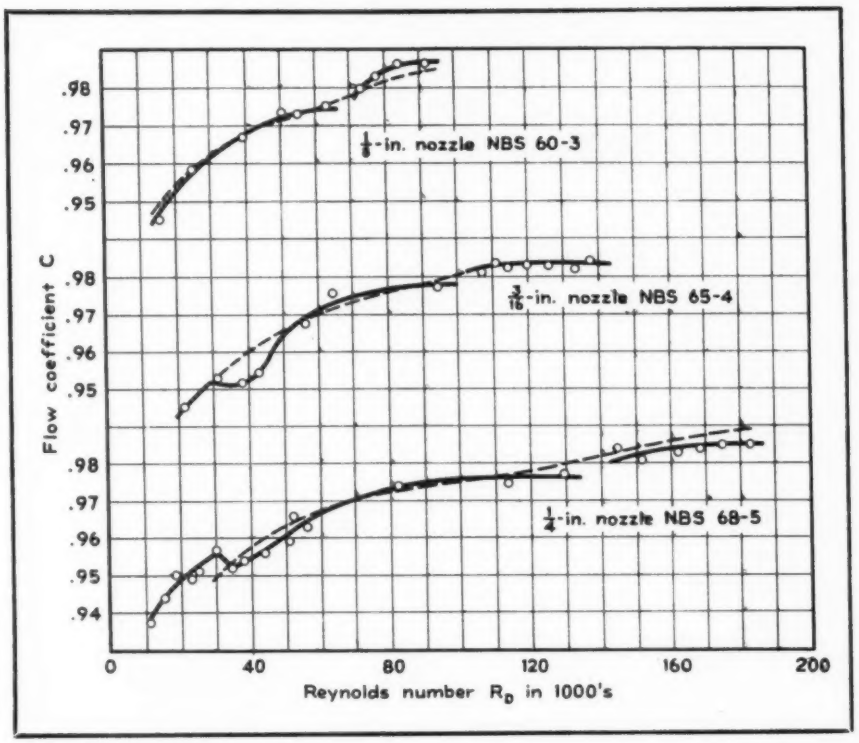
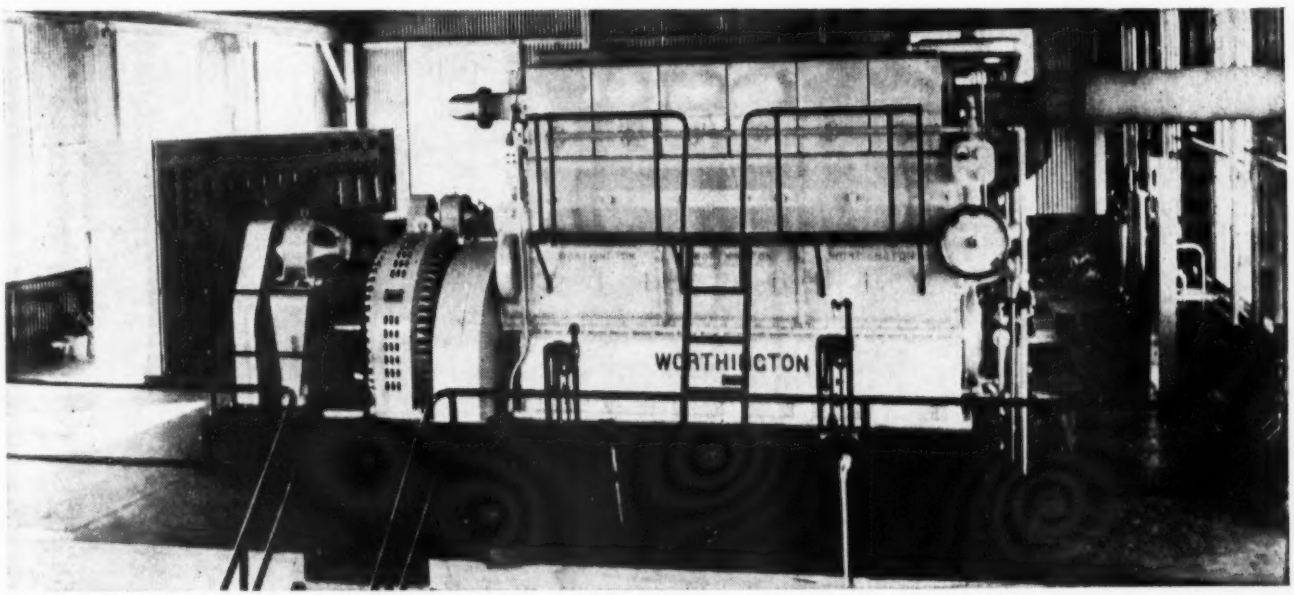


Fig. 12—Some nozzles exhibited irregularities in their calibration curves, but the deviations from average curves were within limits that are acceptable for most testing needs

Pipeline Uses Copper-Oxide Rectifiers

▶ ON EACH of 58 compressor engines on the new 24-in. high-pressure gas line, 700 miles long, from Corpus Christi, Tex., to Cornwell, W. Va., Westinghouse copper-oxide rectifiers supply primary ignition current. Engine ignition is dc, impulse type, with individual induction coils for each spark plug, instead of conventional magneto. Primary supply is 440 v, 3 phase, 60 cycles; output is 10 to 14 v, 2 to 4 amp, dc, enough for all engines. Each copper-oxide unit has voltmeter, ammeter, circuit breaker and rheostat.

Copper-oxide unit provides foolproof interlock between main-line compressor engines, water-circulating pumps and station-service generators. If latter fail, resulting electric power loss stops circulating pumps that cool compressor. Since compressor-engine ignition system also shuts down, compressors stop when circulating-water pumps go out; thus main engines cannot overheat by running after cooling-water system fails. Another advantage: Copper-oxide unit makes each machine independent.



Typical interior of seven original power stations in Tenn. Gas & Transmission Co line; 312-kva 440-v 3-phase 60-cycle station-service generators provide power for all electrically driven auxiliary services; at left: the control switchgear

Cooling Water Serves Plant Twice Before Going to Process

Faced with the problem of mounting water consumption, D F Keegan, General Electric Co, not only devised a way to stop the increase but also cut plant usage drastically. A recirculating system, which added makeup to reduce cooling-water temperature, proved the most practicable solution

► DURING A SIX MONTHS' PERIOD in 1943, our Pittsfield Works showed a 35% increase in water consumption for machine cooling purposes. This increase, 140,000,000 gal, cost about $9000 and placed a tremendous load on the city's water facilities, which were already operating near their full rated capacity.

Our increased demand was caused primarily by one rapidly expanding manufacturing section—the logical place to look for conservation possibilities. A study of the section was started to determine the proper cooling requirements of the many vacuum pumps. Thorough checks were made on water consumption, temperature rise, and pressure changes at various points in the system.

Would Conserve Water

Information obtained clearly showed the possibility that a recirculating system would conserve water and prompted a further study of all machines within an area that could be included in the hookup. When making tests to determine temperature rise, we took care to select those machines receiving the most severe use. Of 118 machines in two buildings, 35 could not use a recirculated water of higher temperature without getting too hot.

However, water from the 35 machines could be used as makeup on the recirculating system for the other 83. Studies revealed that the cooling water could rise 18 F above the normal 52-F temperature of the city-water supply without impairing operating efficiency of the latter machines.

After selecting the proper location from a standpoint of efficiency and economy, a receiving tank and two circulating pumps, Fig. 2, were installed. The two pumps are so wired that they do not operate simultaneously, and each has a relief valve discharging back to the receiving tank.

The tank, 18x8x3 ft, receives all water returned from the cooling system. It is equipped with a temperature control wired to a motorized valve and a float-operated control valve, Fig. 1, which keep the water at the desired temperature by admitting city water to the tank as needed. If water tempera-

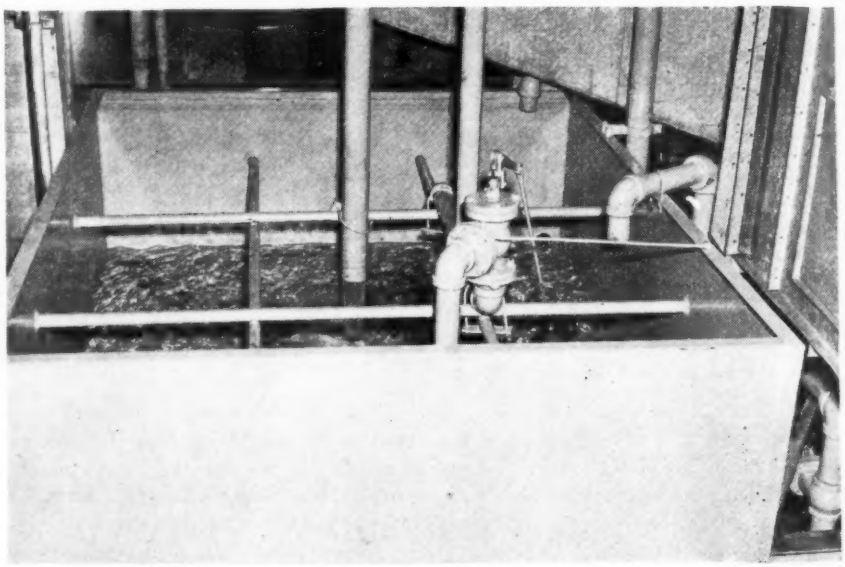


Fig. 1—Receiving tank and return pipe through which more than 500,000 gal of water circulate daily. Float-operated valve protects against low water

EXPENDITURES AND SAVINGS

COST OF FIRST RECIRCULATING-WATER SYSTEM:

Fabrication and erection of tank (10x8x3 ft)	$700
Pumps* (2), foundation and installation	325
Valves	285
Controls	250
Piping and fittings	2198
Electric wiring	450
Painting	60
Engineering	500
TOTAL	$4768

*Pumps were on hand. Their purchase would have added approximately $1,200 to total cost

SAVINGS WITH RECIRCULATION:

Location	Cost	Net saving: Water, gal.	Net saving: Dollars
Capacitor section	$4768	241,000,000	$15,424
Plating section	2794	35,000,000	2,240
Division I	6687	91,000,000	5,824
Division II	5500	30,000,000	1,920
TOTAL	$19,749	397,000,000	$25,408
Less power depreciation and maintenance			2,836
NET SAVING			$22,572

ture reaches 70 F control valve opens and city water is added until recirculating water falls to 64 F.

Careful thought was given to the receiving-tank overflow. If power fails, making it necessary to turn on city water, a 6-in. overflow pipe carries away excess water easily. Another consideration, also in case of power failure, was the protection given to the city-water supply. Dual check-and-stop valves, Fig. 3, installed in the service line, make it impossible for recirculating water to get back into the city main and contaminate city supply.

Further Benefits

Further benefits of the recirculating system came from using the overflow water. In one instance this was piped to a plating section in another building where it served for rinsing. This department was previously supplied from a direct city-water line, and after the rinsing operation the water was unsuitable for other purposes. Another use of the overflow was in the toilets of 30 washrooms. Here it superseded lake water, thereby improving sanitary conditions. Thus the water served three purposes before being discarded.

Recirculating-system installation was completed in Dec, 1943, at a cost of $4768. In 1944 it saved about $15,424 and reduced the demand of the city of Pittsfield's water supply by 241,000,000 gal. Incidentally, the water thus saved would fill a reservoir 50 ft deep, 640 ft wide, and 1000 ft long.

In addition to the recirculating system described, the Pittsfield Works has three other systems now operating (see table). Second system put in operation, in the plating section, used overflow water from the receiving tank of the original system. Full operating efficiency for the plating-section system was obtained in Sept, 1944. Based on records to date, it will save about 35,000,000 gal of water a year.

Ultimate Saving

The third recirculating system reached full efficiency in April, 1945, with an actual saving of 91,000,000 gal of water. Ultimate yearly saving for this system has been estimated at 120,000,000 gal.

A fourth system, also in operation, has not reached full efficiency although for the month of May a yearly estimate of 30,000,000 gal was saved. This installation, after a few minor changes are made, is expected to save the original estimate of 47,000,000 gal per year. The cash outlay will be repaid many times over by cost of water saved.

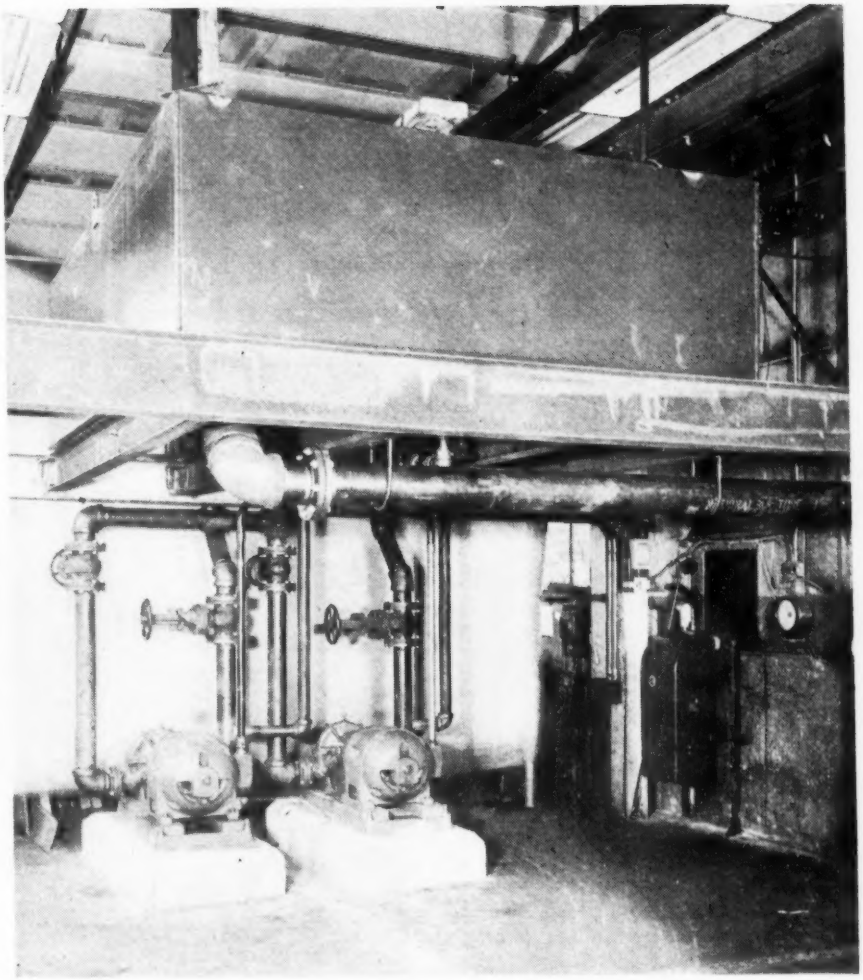


Fig. 2—Receiving tank mounts on I-beams above the two motor-driven circulating pumps. The 6-in. line hanging beneath the tank carries overflow to process

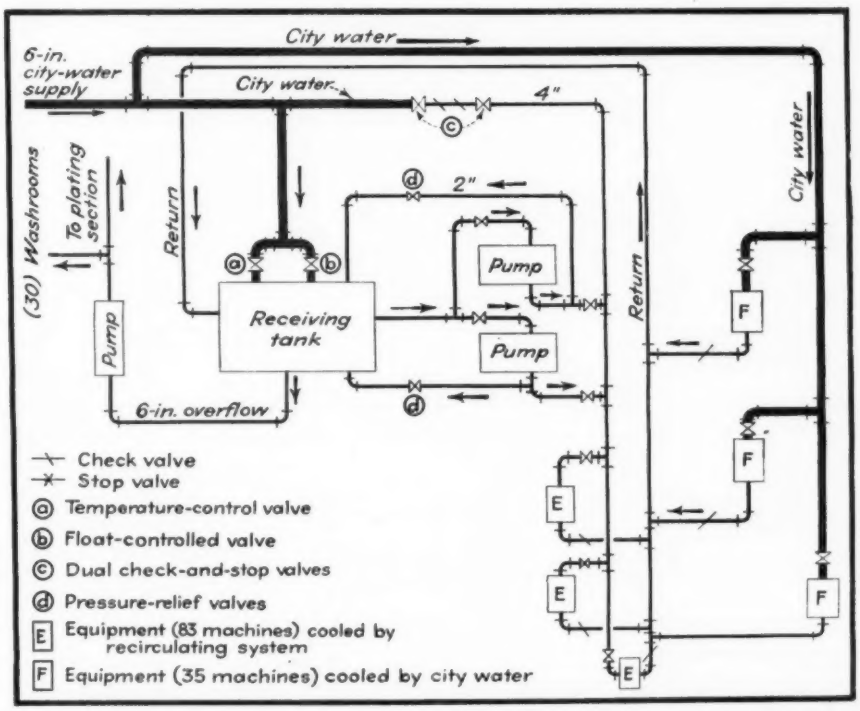


Fig. 3—Circulating system feeds cooling water from one group of machines to another. Properly located check valves prevent backflow into city supply main

'Half-Soled' Impellers Extend Life Of Large Circulating-Water Pumps

F G Philo, superintendent of steam generation, Southern California Edison Co, tells how the vanes of bronze impellers for two 50,000-gpm condenser circulating-water pumps were repaired, first with cast bronze and later with monel half soles, when they became badly pitted from cavitation effects

Fig. 1—Lower half of cast-iron casing for one of two 50,000-gpm double-suction twin-impeller steam condenser circulating-water pumps handling sea water

► HERE'S HOW the Long Beach steam station, of Southern California Edison Co, used monel plates, or "half soles," to repair pitted areas on the bronze-impeller vanes of two large condenser circulating-water pumps that handle sea water. Fig. 1 shows lower half of the cast-iron casing for one of the pumps and Fig. 2, opposite page, its twin double-suction impeller. Areas *B*, Fig. 3, show where bronze repair plates were first applied and then removed from the runner vanes. Small pitted area *C* shows the portion of the vane's suction edge that remains after a considerable area of the original metal was chiseled away. Cast patch pieces were fitted into the areas thus cut away.

Impeller Conditions

Impellers are 48 in. diameter, and each pump is rated 50,000 gpm at 296 rpm. Although the pumps have been in service for 17 years impeller vanes were first repaired only four years ago. Mechanical condition was good except erosion and corrosion caused by cavitation at the entrance ends of the impeller vanes. It was therefore decided to restore the vanes to approximately their original condition and size by applying thin-metal shoes.

First repairs were made with bronze half soles, cast about ⅛ in. thick, 10 in. long and 6 in. wide. These castings had a flanged end that hooked over and replaced the original vane end, which had practically disappeared.

Pitted areas of the vanes required preparation for the repair plates. The original metal was cut away to insure a good fit and the bronze plates were peened snugly into position over the vane ends and against the sides of the impeller shroud rings and splitter ring dividing the vanes. Holes were drilled through the vanes to plug-weld the plates in place.

When the pumps were put into service the bronze shoes pitted as fast or faster than the original vanes so that within a few months they needed replacing. Fig. 4 shows one of the pitted shoes after removal from the impeller. Effects of erosion and pitting are clearly indicated all over its surface. Rapid failure of the bronze shoes was probably due, at least in part, to operating the plant at light load to supplement hydro-electric plants. During this period only one pump was in use; consequently it operated above its design capacity.

Because monel shoes were expected to have high resistance to pitting action of cavitation, new shoes were cast of this alloy instead of bronze. An alloy of low silicon content (about 1.25%) gave best results. Shoes had to be sufficiently malleable to be peened to a snug fit with the impeller surfaces. Plug-welding the shoes to the vanes was abandoned in favor of completely arc-welding their edges to the vanes and their shroud rings.

Before attaching the shoes to the impeller vanes a number of different welding rods were tried on test pieces, and Aerisweld rods (Lincoln Electric) were found the most satisfactory for joining monel to bronze on this job. After the shoes were welded in place excess bead metal was removed by grinding to make the vane surfaces smooth and uniform.

Fig. 5, page 98, shows size of the

patterns that were used in casting the monel shoes. Fig. 6 and 7 show the condition of these shoes after 18 months' service in sea water. The shoes are fairly smooth, much more so than the impeller body. Across their rear edges, Fig. 6, the welding metal has been destroyed by cavitation, but the shoes remain intact. In Fig 7 the pitted welding beads, Fig. 6, have been restored to their original condition.

One pump was first equipped with the monel shoes and placed in service. After several months' operation the impeller's condition was checked and found highly satisfactory. The bronze shoes on the other pump were then replaced. After about 18 months' operation a second examination showed the shoes had lost a negligible amount of metal, if any. However, there was pitting in the welds, which required some additional welding to fill small cavities.

Eventually it is expected that these pumps will be equipped with 2-speed control so that they will keep operating on their design performance curve when handling reduced loads. This should reduce cavitation and its effects on the impeller vanes. Until that time, the vane repairs are expected to hold.

(*Continued on page* 98)

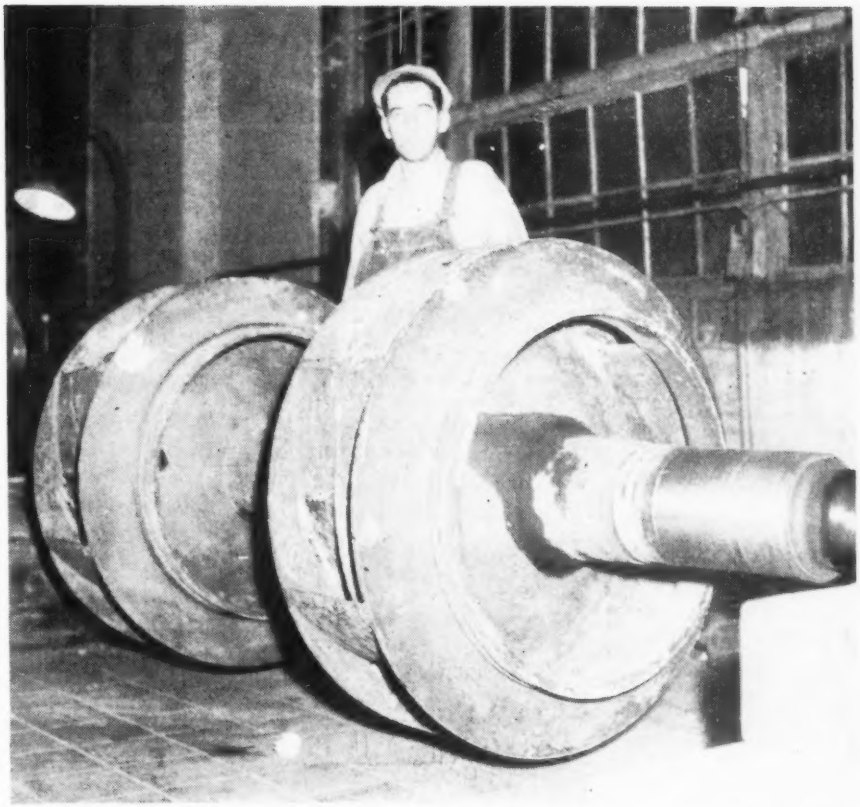


Fig. 2—Bronze twin double-suction impellers for one of two condenser circulating-water pumps. Pitted areas on vanes of these impellers were first repaired by cast-bronze plates, plug-welded in place, later by thin cast-monel plates

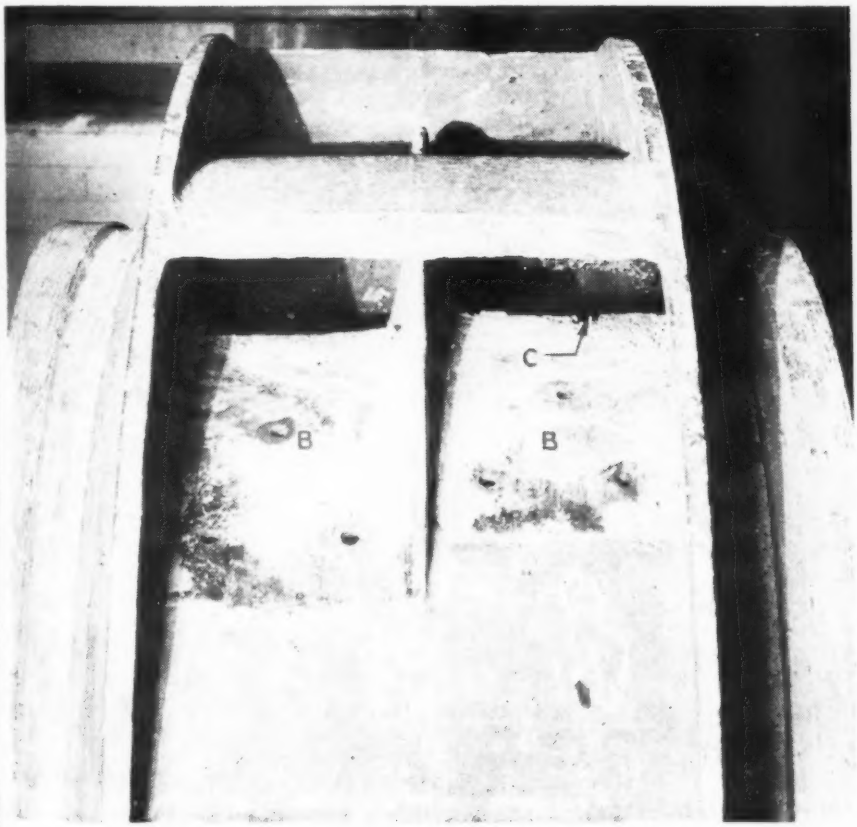
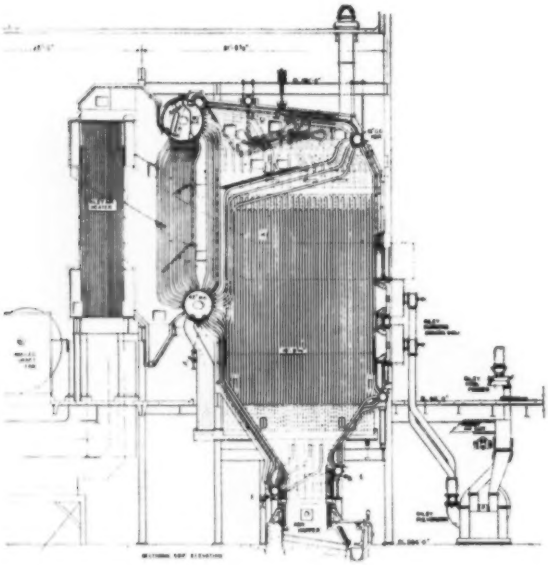


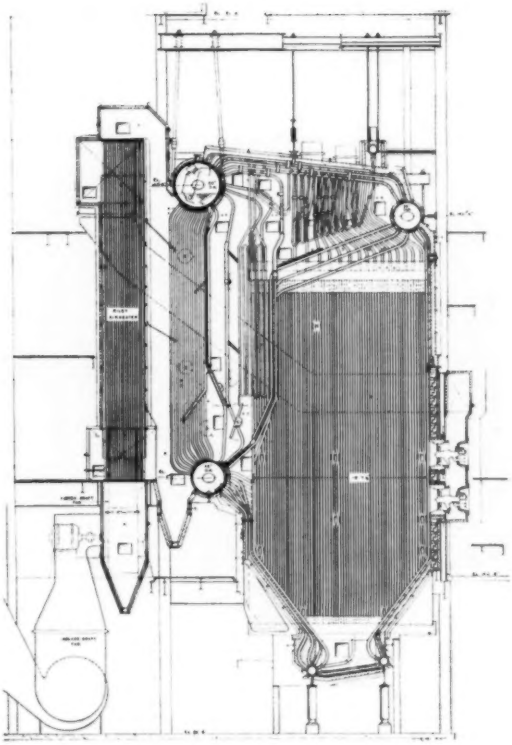
Fig. 3—One of the impeller vanes after the bronze sole plates were removed because they were badly pitted. These plates, hooked over suction end of vanes, were peened in place to a good fit and plug-welded through holes in the vanes

Fig. 4—One of the badly pitted half soles removed from the impellers after they had been in service a few months. Both cast bronze and S monel, with a 3.59% silicon content, pitted badly. S monel was too hard and not suited to resisting the pitting effects of cavitation. It was then decided to make the sole plates from monel with a silicon content of 1.25%. This alloy shows high resistance to effects of cavitation after 18 months' service

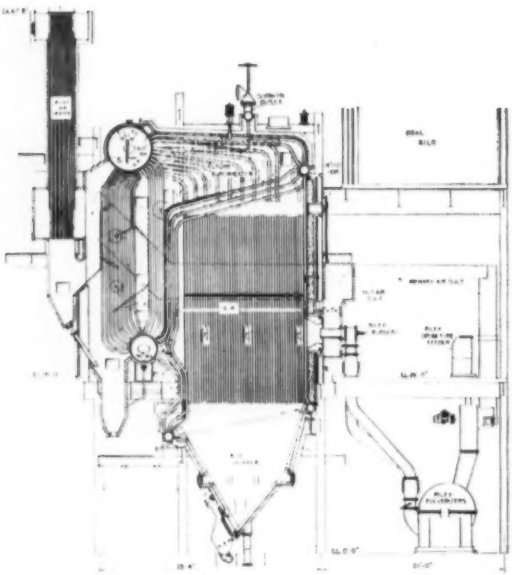
A few Recent Installations o

Large Chemical Plant, Institute, W. Va.
175,000 lbs./hr.—450 lbs.—575°F.
This Company has installed 16 Riley Boilers
Ford, Bacon & Davis, Engineers





Mississippi Power Co., Hattiesburg, Miss.
230,000 lbs./hr.—975 lbs.—860°F.
This Company just recently placed a repeat order
for a duplicate unit



Publicker Commercial Alcohol Co., Philadelphia, Pa.
100,000 lbs./hr.—450 lbs.—750°F.
United Engineers and Constructors, Engineers
This Company has installed 9 Riley Boilers

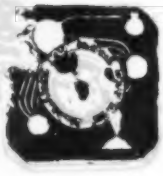
Six Modern Riley Installations

We Will gladly send you 1/8" scale drawings of these installations if you will write us on your company's stationery

The Riley installations illustrated are good examples of the character and quality of moderate sized Riley Steam Generating Units being installed by so many of the country's leading industrial and central stations.

Because of their satisfactory performance and thorough dependability; because users have found that they can count on Riley units to exceed guaranteed performance; and because of conscientious services rendered by the Riley organization, there has been a definitely growing preference for Riley boiler units.

Keep your eye on Riley and before purchasing steam generating units visit a number of Riley units to see for yourself how well they perform.



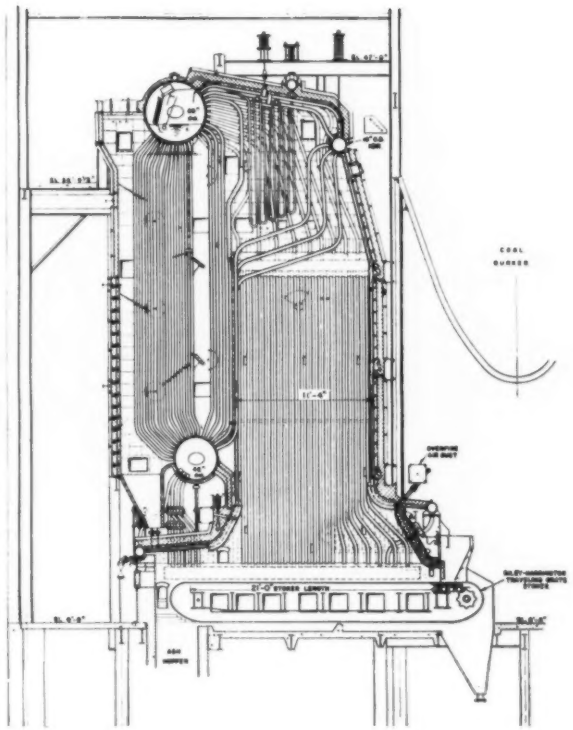
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Buffalo Cleveland Detroit Tacoma Baltimore Milwaukee Denver St. Louis Cincinnati Houston Chicago St. Paul Kansas City Los Angeles Atlanta Memphis New Orleans

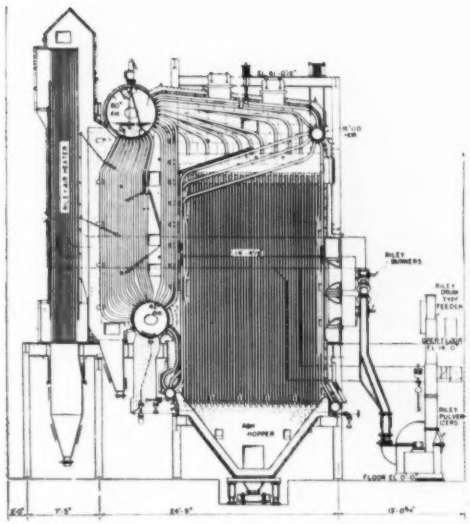
It will pay you to visit modern Riley Installations

Riley Steam Generating Units



A. E. Staley Mfg. Co., Decatur, Ill.
90,000 lbs./hr.—450 lbs.—700°F.
Burning Illinois Coal
Vern E. Alden, Consulting Engineer

U. S. Rubber Reclaiming Co., Buffalo, N. Y.
60,000 lbs./hr.—350 lbs.—Saturated
W. E. S. Dyer, Buffalo, N. Y., Consulting Engineer

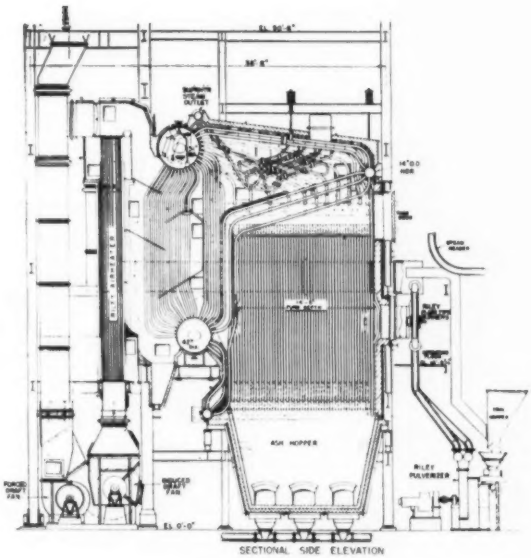


A Quite Significant Fact

Since the first of this year, 73.6% of all Riley Steam Generating unit sales has been received from old Riley customers. Good proof of the excellent results being obtained by Riley users.

Here are a few companies who placed repeat orders:

Scovill Mfg. Co.
Houston Light & Power Co.
Celanese Corporation
American Cyanamid Co.
Central Illinois Light Co.
Forstmann Woolen Co.
Modine Mfg. Co.
Standard Oil Co. of La.
Otter Tail Power Co.
Rochester Dairy Co.
Draper Bros.
Standard Oil Co. of N. J.
Beechnut Packing Co.
National Lead Co.
Owens-Corning Fiberglas Co.
Mississippi Power Co.
International Business Machines
Worcester Gas Light Co.
Starline Inc.
Fort Bend Utilities Co.
Holly Sugar Co.
Putnam Finishing Co.



SECTIONAL SIDE ELEVATION

Savannah Sugar Refining Co., Savannah, Ga.
55,000 lbs./hr.—350 lbs.—600°F.
This is the second Riley Unit installed in this plant

Survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

Consult Riley before purchasing Boiler or Fuel Burning Equipment

Half-Soled Impellers Extend Life of Large Circulating-Water Pumps

Continued from page 95

Fig. 5—Patterns, and their dimensions, for casting the monel half soles for impeller vanes. These half soles are about 7 in. wide and 11 in. long, cast with a lip that fits over the suction edge of the vanes. The plates were first peened to a snug fit on the vanes and then electric arc-welded in place

Fig. 6—This photo shows the condition of the monel half soles after being in service 18 months. They are in good condition; in fact, smoother than the rest of the impellers, but the welding beads at W have been pitted by cavitation. The white splotches are highlights, not pitting of the metal

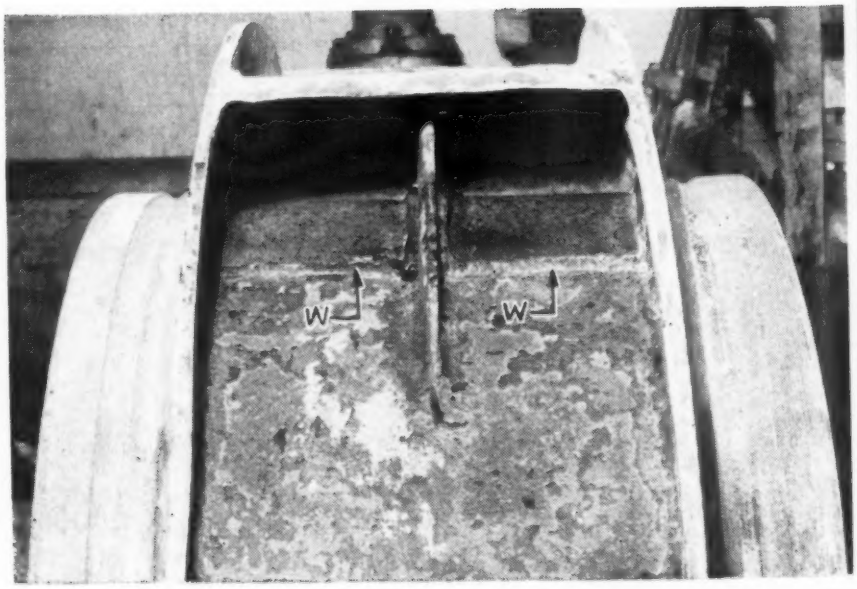


Fig. 7—The same impeller as in Fig. 6 after the pitted welding beads W have been restored to their original condition to hold the half soles securely in place. After the welds were repaired the pump was returned to service and will probably be good for at least 18 months' more service before the half soles of the impeller vanes will again require some attention

LABOR *and* MANAGEMENT MEET— *for* PEACE *or* CIVIL WAR?

THE prospect of a knock-down and drag-out fight in the automobile industry does not augur well for the reconversion outlook, which upon every other score is bright. Any widespread outbreak of the type of industrial warfare which now threatens will disrupt, more thoroughly than anything else on the horizon, an orderly transition to a peacetime economy.

It is doubly unfortunate that there should be a general tightening of union and company battle lines upon the eve of the Labor-Management Conference, which on November 5th will convene at President Truman's direction for the purpose of "working out by agreement means to minimize labor disputes." If the current work stoppages occasioned by industrial conflicts should increase rather than diminish between now and November first, the Conference atmosphere hardly promises to be favorable to a dispassionate examination of basic issues.

Yet the shadow of the threatened industrial storm that hangs over the Conference only serves to emphasize the importance of reaching satisfactory agreement upon two problems with which such a Conference might deal. The first is that of determining what machinery shall be used for settling disputes upon which employers and workers have reached an impasse. The second, and more far-reaching, is that of arriving at some common understanding upon the major issues which commonly lead to irreconcilable disputes.

Settlement of Wartime Disputes by the War Labor Board

During the war the first problem was handled largely by machinery centered in the National War Labor Board. Supported by general adherence to patriotic pledges by labor leaders and employers not to resort to the use of economic force against each other during wartime, and backed up on rare occasion by use of the President's power to seize plants for war purposes when its orders were not obeyed, the Board managed, by what amounted to compulsory arbitration, to settle the nation's wartime labor disputes with relatively little economic loss.

But it can scarcely be claimed that the War Labor Board did much to resolve the issues from which disputes grow. Indeed, the fact that it was available to issue orders in cases which the Secretary of Labor certified as likely to "lead to substantial interference with the war effort", resulted in the conversion into full fledged disputes of many disagreements which would otherwise have been settled at a local level in the course of collective bargaining. Meanwhile, local collective bargaining machinery which should have been doing most of this work was neglected, and will need thorough reconditioning even to be brought back to its prewar level of effectiveness.

With V-J Day came an abrupt change in the status of the War Labor Board. One of its main props, labor's "no strike pledge", was promptly withdrawn. It could no longer rely on the President to use his power to seize plants for war purposes to force obedience to its orders. Consequently the Board agreed that it would accept new cases only if both parties to the dispute stipulated in advance that they would abide by the Board's findings, that it would clear its dockets of old cases as rapidly as possible, and that it would then go out of business, leaving to the Labor-Management Conference the question of what should take its place in the postwar period.

What Shall Take the War Labor Board's Place?

The immediate and pressing task of the Labor-Management Conference is to agree upon machinery for settling industrial disputes in the peacetime economy.

Neither management nor labor wants the continuation of compulsory arbitration to which they submitted as a necessary war measure. But it must be clear to everyone that if any substantial proportion of the disputes that inevitably arise are settled by resort to strikes and lockouts, economic anarchy will result. Not only will it be impossible to achieve the high levels of output and employment that have been set as postwar goals, but it is questionable whether our economy could survive. The only alternative to compulsory arbitration under government auspices is for management and labor to demonstrate their ability to effect a peaceable resolution of their differences without it.

The most obvious need is to set up local machinery at the grass roots where disputes originate. That is where most of them should be settled by local negotiation and, when that fails, through voluntary submission to mediation or arbitration under terms of reference to which the parties agree. Many issues, which at plant level are relatively simple in character, are blown up to formidable dimension and complexity when they are passed along

the line for decision in Washington. The centralizing process is one that frightens everyone connected with it because it focuses attention upon the possible importance of precedents established by a decision, rather than upon resolving satisfactorily the particular dispute at hand.

Unquestionably, some Federal machinery must be provided which may be called upon in cases where the size or implications of a threatened dispute clearly run beyond local jurisdiction. That will mean the thorough revamping of conciliation and mediation machinery which exists, but which has grown rusty through disuse while compulsory arbitration was the order of the day.

At least, this involves a complete overhauling of the United States Conciliation Service with a noteworthy strengthening of its personnel. There may be wisdom also in recently advanced suggestions for the creation of a board of arbitration to act in cases voluntarily submitted by the parties concerned, and for boards of inquiry to make reports upon the merits of disputes in which the public interest is concerned. But there is valid ground for questioning what appears to be the common assumption that such machinery should be located in the Department of Labor. It belongs neither there nor in the Department of Commerce. For the work which such agencies are called upon to perform, both the appearance and fact of complete impartiality are essential to effective performance. Assurance of impartiality will not be fostered by placing them in a department specifically charged by Congress with the task of advancing the interests of wage workers.

Resolving the Issues Over Which Disputes Arise

It may be, as many think, that the forthcoming Labor-Management Conference cannot effectively handle any problems beyond the procedural ones suggested above. If that is true, its agenda probably should be restricted to planning the reconstitution of collective-bargaining and dispute-settlement machinery, in view of the urgent need for putting it in working order.

But either in this Conference, or in subsequent ones, there will have to be an attempt to reach a reasonable measure of labor-management accord upon certain basic issues over which most industrial disputes originate. The best of machinery can be swamped if disputes are generated in ever-increasing number.

Most important of such issues is that of the fair determination of wages. There is clear need for reaching agreements at least upon the major factors on which such determination should rest. It seems evident that if we are ever to hope to reach the high levels set and generally accepted as postwar goals, we must harness economic incentives to promote production efficiency. That means that workers, as well as management, must be given a genuine stake in increased productivity. No universal formula is possible, but we should be able to agree upon general principles for dividing returns derived from improved performance in output between workers and investors, and consumers in the form of lowered prices.

Again, since unionism is here to stay, general acceptance by management of the principle of collective bargaining would save innumerable disputes which are concerned more with the method of negotiation than with the concession sought. Few in management still question the validity of the collective bargaining process as such, but there are many matters to be resolved of which the question of the open shop, the union shop, or the closed shop is merely a conspicuous example, upon which there is wide divergence of conviction between and within labor and management groups.

On the management side, there is sincere concern about the intent or ability of union leaders to exercise responsible control that assures compliance with contractural obligations. Wild-cat strikes are of sufficiently frequent occurrence to give substance to this distrust, and union discipline seldom has been administered in a decisive or effective fashion. The prospective rivalry of three competing labor organizations of national scope gives management little confidence that a bargain made and kept in good faith with any one of them provides assurance against work stoppages.

All of these matters, and many others, need thrashing out between management and labor, with the view of arriving at as large a measure of specific and detailed agreement as can be achieved. The greater the area of such agreement, the smaller will be the area for disputes that must be handled by settlement machinery, or put to the final test of force.

Peace or Civil War in Industry

The Labor-Management Conference is of major importance to national welfare. It is important even if it restricts its objectives to the procedural problem of how industrial disputes are to be handled.

It can make an even larger contribution if it lays the groundwork for an attempt to reach working agreements upon such policy issues as have been cited above.

Neither management nor labor can afford to lend anything less than their best intelligence and effort to an attempt to arrive at common understanding. Success will mean that we have a genuine chance of reaching new levels of economic well-being. Failure will mean industrial civil war, in which the casualties will be high. One almost certain casualty of such a war will be the principle of collective bargaining, since the Government can scarcely refrain from establishing compulsory arbitration if sufficient breakdown occurs.

It is to the vital interest of both management and labor to demonstrate that they can responsibly control themselves.

President McGraw-Hill Publishing Co., Inc.

Here's a Thrifty Schedule For Washing Steam Turbines

Blade and nozzle deposits still have to be removed periodically to restore turbine capacity and efficiency. Prolonged operation or too frequent cleaning may unduly increase costs. Here are dollars-and-cents fundamentals of figuring schedule

By B G A SKROTZKI, *Assistant Editor*

▶WHILE CONSIDERABLE PROGRESS has been made in minimizing carryover of solids in steam from boiler drums, many operators still have to wash turbine blades and nozzles free of deposits periodically to restore turbine efficiency and capacity. If washing is necessary, it is important to set up a schedule designed for minimum total cost of efficiency loss and actual cleaning costs.

For most conditions, a simple rule of thumb is sufficient: *Wash the turbine when cost of accumulated energy loss, measured from the time of last cleaning, equals the cost of washing. If washing is done earlier or later than this, total cost of fouling and washing increases.*

Turbine fouling has two direct effects: (1) increase in nozzle-bowl and turbine-shell pressures and (2) loss in maximum turbine capacity. Probably the easiest way to measure degree of fouling is a periodic check of maximum output with wide-open governor valves. However, if operating conditions do not allow carrying full load, fouling can be measured by pressure gages tapped into several turbine stages. Degree of fouling is expressed either in terms of percent loss of maximum capacity or in a weighted average rise in stage pressure at a given load.

Where instrumentation is adequate, increase in heat rate (or decrease in efficiency) is determined by test or daily performance analysis. No two turbines are necessarily affected alike by the same degree of fouling.

For a turbine with a load cycle that follows a repeated periodic pattern, it is possible to find increase in average heat rate caused by a given degree of fouling. Tests show that this relation is close to a straight line; that is, a factor can be established for a given turbine that represents heat-rate increase (in terms of *boiler input*) in Btu per kwhr for each percent of fouling, as measured either by loss of capacity or increased stage pressures.

Fouling rate varies somewhat with turbine load schedule and is also affected by any change in feedwater treatment or character of makeup. On the whole, fouling rate for periods up to several months tends to remain constant. However, when comparing different periods of a year (or different years) fouling rate may vary markedly for the same turbine. Usually fouling rate can be assumed constant for determining the washing schedule, but testing will pay to make certain of this.

Increase in energy input (to the boiler) is a function of average operating load, increase in heat rate per percent of fouling, rate of fouling and number of hours operation between cleaning. If load and fouling rate are essentially constant, heat-rate increase is a straight line, Fig. 1.

Total Btu energy loss, and hence cost in terms of fuel because of not being able to keep the turbine clean, is the accumulated heat loss represented by the shaded area in Fig. 1. The value of the accumulated dollar loss can be plotted (a "square" curve) as in Fig. 2.

Determining Minimum Cost

To determine right number of hours to allow between cleanings, take into account the washing cost, which includes labor, materials, supplies, cost of taking turbine out of service and, usually, cost of replacing its output with that of a less efficient machine during outage. Total cost *per hour* of machine operation is the sum of the extra Btu input during each hour plus the washing cost up to that hour, averaged over the time period being considered. Fig. 3 shows this relation graphically. Efficiency loss averaged *per hour* is a constantly increasing cost, a straight line. Washing cost is a lump sum divided by the number of operating hours elapsed up to any given point on the curve.

Obviously, the turbine should be taken out of service for washing when the total cost *per hour* is a minimum. Every additional hour of operation wastes more money in fuel than is saved by

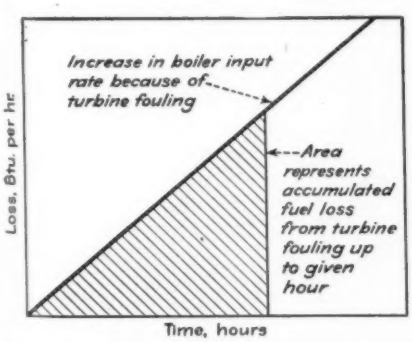

Increase in boiler input rate because of turbine fouling
Area represents accumulated fuel loss from turbine fouling up to given hour
Loss, Btu. per hr
Time, hours

Fig. 1—Typical effect of fouling is straight-line increase of input, Btu per hr, with operating hours since last cleaning. Total accumulated heat loss (area under line) increases more rapidly than time since last cleaning

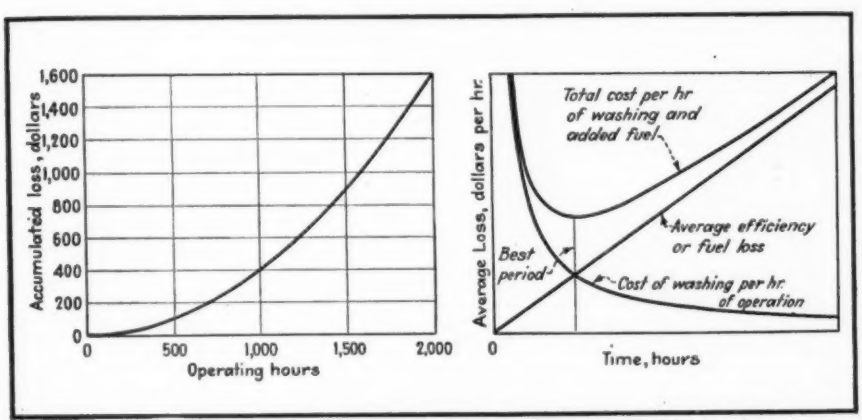


Fig. 2—Example of variation of accumulated energy loss with total operating hours since last cleaning. Fig. 3—Typical variation of total average hourly fouling loss and of both components with operating hours since last cleaning

extending the washing period, whereas too frequent cleaning does not produce sufficient fuel savings to warrant the expenditures for the added cleaning. For the conditions assumed—that is, a constant fouling rate—this time occurs when the cost of Btu loss per hour equals the cost of washing per hour, as in Fig. 3.

Suppose washing cost has been calculated as $500. If the turbine is allowed to run 500 hr with dollar loss calculated in Fig. 2, the accumulated loss is $100, making a total of $600. If 500 hr were established as the period between cleanings cost per hour would be $1.20. If 1000 hr were arbitrarily chosen, the accumulated fuel loss would amount to $400, from Fig. 2; total would be $900 and cost per hour $0.90. For a 1500-hr period, cost per hr becomes $0.93 and for 2000 hr, $1.05. Thus the optimum period is somewhere in the neighborhood of 1000 hr.

Note that the total-cost-per-hour curve, Fig. 3, is relatively flat where it reaches minimum value. This indicates that the periods between washings may vary as much as 20% shorter, or longer than the theoretically best point without greatly affecting the over-all economy.

To make computation easy, the chart of Fig. 4 shows the relation of the various factors and a graphical solution to the problem of determining optimum washing period when the turbine-fouling characteristic is known or assumed. Great accuracy in this determination is not necessary because of the 20% variation allowable between cleaning periods. Fig. 4 is based on a turbine fouling characteristic having the straight-line shape shown in Fig. 1. If the shape is markedly different, Fig. 4 cannot be applied.

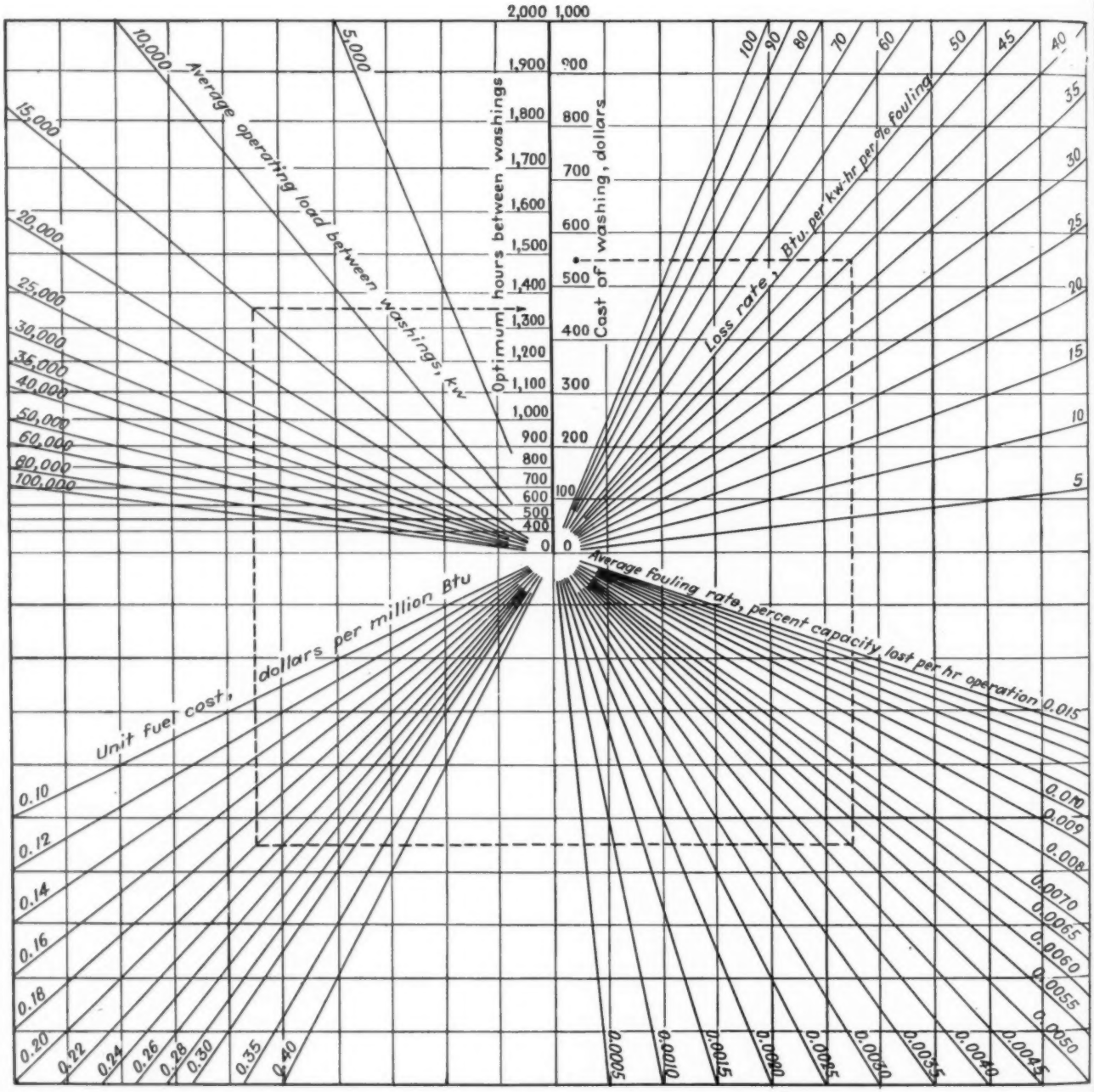


Fig. 4—Chart for determining optimum number of operating hours between washings when cleaning cost, fouling rate and loss have been established. Example: Washing cost totals $550, loss rate 40 Btu, fouling rate 0.005% per hr, fuel cost $0.20 per million Btu, average load 15,000 kw. Clean turbine after 1360 hours of operation

Fluorescent Flashing Is a Danger Signal

An ordinary starter flashes incessantly in attempting to start a deactivated lamp — one whose cathode electron-emissive coating is used up. Unless the lamp is removed or the circuit opened reasonably soon, starter or ballast will be damaged

By ROBERT R WYLIE
Commercial Engineer
Sylvania Electric Products, Inc

▶WHEN a fluorescent lighting fixture fails, first thing to check is the lamp itself because throughout lamp life the electrodes gradually lose their emissive-material coating. This deterioration is caused by (1) boiling-off action that takes place during the preheating or starting period (2) bombarding and consequent knocking-off action that occurs during normal lamp burning. When a lamp ceases to burn it should be disconnected from the circuit either manually or electrically; otherwise, the ballast may be damaged. The following discussion of starters, their functions and operation explains how this is done.

Purpose of a starter is to preheat the cathodes in a short time (2 to 5 sec) causing them to emit a cloud of electrons at each end of the lamp. It then opens the heating circuit suddenly and the lighting arc establishes itself by an inductive surge from the ballast. From that instant the starter is out of the circuit.

The simplest starting device is a manual switch, Fig. 1, used mostly on desk lamps and other small portable equipment. Switch *A* turns on the current, then switch *B* is held closed until the lamp ends glow, indicating adequate preheating of the cathodes, after which *B* is released. Opening switch *B* induces a voltage surge in the ballast great enough to establish the arc. Disadvantage of manual starting is the operator's tendency to hold the starter switch closed too long, causing an overabundance of emissive material to boil off the cathodes and thereby shorten lamp life. Manual starting is not recommended for large installations or inaccessible fixtures. Here automatic devices are generally employed.

Automatic Starters

Simplest automatic starter is the glow type, Fig. 2, which consists of a glass bulb containing two electrodes and filled with argon gas. Electrode *A* is a bimetal strip. When voltage is impressed across the lamp ends and starter bulb, resistance through the lamp tube is too high to permit current passage, but gas in the starter bulb ionizes and therefore conducts current. Gas ionization causes a glow and heating, which expands the bimetal strip until it contacts electrode *B*. During this time sufficient current passes through the metal-to-metal circuit to heat the lamp cathodes. Since this contact bypasses the gas circuit in the starter the glow disappears and its heating effect is lost.

Bimetal strip then returns to its original (cold) position and contact is broken. Breaking the circuit causes an inductive surge in the ballast that impresses sufficient voltage across the lamp to start it. This type of starter will attempt to start a deactivated lamp incessantly until worn out itself. Also, this pumping action impresses full starting current across the ballast and in time may damage it. The glow starter is recommended for small and medium-sized installations where lamps can be removed readily when they fail. It does not operate satisfactorily in cold locations because of the nature of its starting action.

The thermal or resistance-heat-operated starter is satisfactory for cold locations. Its fundamental operating principle is the same as that of the glow starter but it accomplishes its objective somewhat differently. When the line switch is closed, Fig. 3, bimetal strip *A* is touching the carbon contact *B*, thus allowing the current to preheat the cathodes. At the juncture of the bimetal strip and carbon, heat is generated by virtue of the carbon's resistance. This heat causes the bimetal strip to move away from *B*, which breaks the circuit and produces a voltage surge

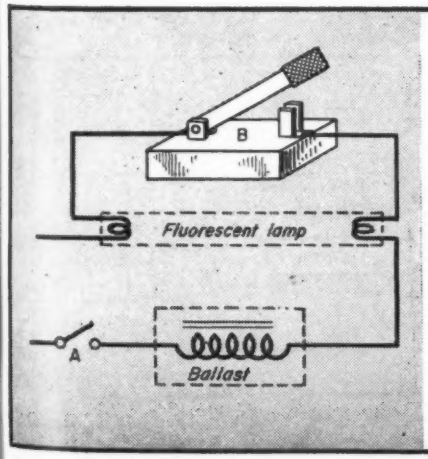


Fig. 1—Manual starter is used on desk lamps and other portable equipment, usually placed within easy reach

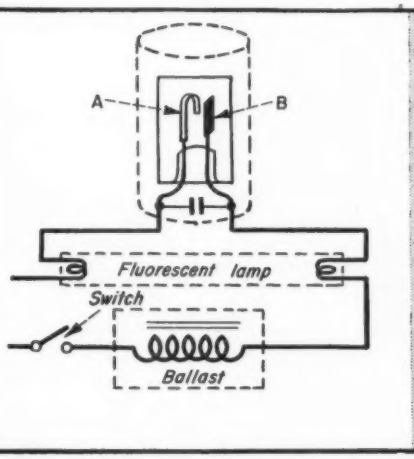


Fig. 2—Heat from ionized gas causes bimetallic strip A to bend and touch other electrode, B, to start the lamp

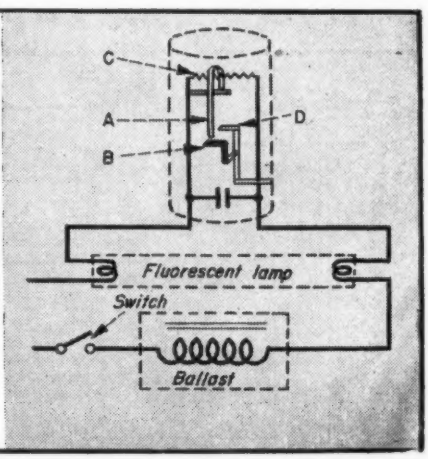


Fig. 3—Thermal unit works successfully in cold locations because its operation does not depend on ionized gas

through the inductance to strike the arc. Resistor *C*, subjected to the same voltage as the lamp, heats up and keeps the bimetal strip away from carbon contact *B*.

If line voltage is interrupted momentarily, extinguishing the lamp, resistor *C* is subject to full line voltage and the additional heat causes the bimetal strip to bend until it touches restart contact *D*. This allows the current to preheat the cathodes again, but at the same time it short circuits *C* so that the bimetal strip moves away from *D*, causing the current to strike the arc again. The thermal starter is an extremely rugged unit, useful in many applications where the glow starter might be objectionable. But the former has the disadvantage that it, too, constantly attempts to start a deactivated lamp until circuit or starter fails.

Automatic Cutout

The glow and thermal starters, just discussed require that a lamp be removed manually from the circuit when it fails. Otherwise, starter and ballast may be damaged. The cutout (push-button) starter has an electrical cutout device that disconnects a lamp from its circuit. It is either a glow or a thermal unit with a built-in circuit breaker, Fig. 4. The unit consists of a small resistor and bimetal latch *A* as one contact, and a phosphor-bronze spring *B* as the other contact. Current passes through these elements, which the latch holds in contact position. When a lamp fails, heat generated in the resistor causes bimetallic strip *A* to bend and release spring *B*, which cuts the lamp out of the circuit. With a new lamp in place, the circuit breaker is reset by pushing button *C* down. These starters are particularly useful where lamps are group-replaced or inaccessible for immediate relamping.

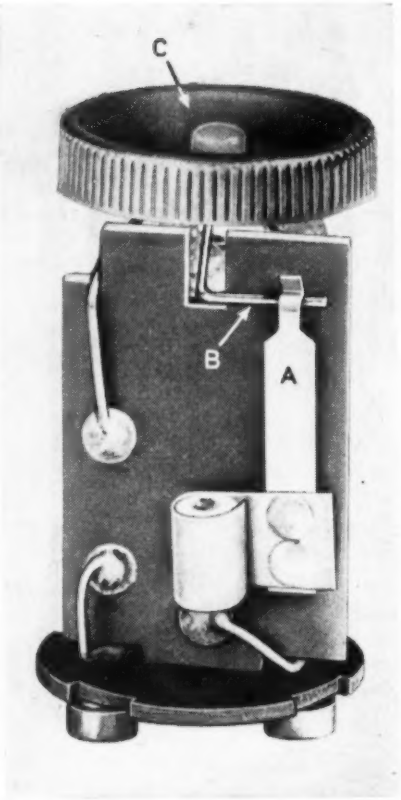


Fig. 4—Automatic-cutout starter protects the ballast because it opens the circuit to a badly deactivated lamp

When a glow or thermal starter fails, it generally welds shut at the contact point, thereby causing straight preheat current to be impressed across lamp cathodes. This soon destroys their electron-emissive coating, and the lamp becomes inoperative insofar as starting voltage supplied by the ballast is concerned. Here faulty action damages both starter and lamp. Since preheat, or starting current, is higher than operating current, the ballast becomes overheated (compound melts out) and is permanently ruined. Often a hum occurs first, which indicates that more serious trouble will follow.

A characteristic of most electric-discharge devices is that they are not self-limiting as to current flow and, without a suitable choke, soon destroy themselves (and usually the equipment operating them) by simply overheating. The ballast, a choke coil of laminated-iron core wound with a suitable coil, is a current-limiting device without which current within a lamp would rise instantly high enough to destroy it.

Condenser's Purpose

A condenser to inhibit radio interference and correct power factor of the inductive coil is desirable and usually incorporated. Entire assembly is embedded in an insulating compound and incased in a steel housing with only the connecting wires protruding. Fig. 5 shows the internal elements of a ballast and the complete circuit for a typical 2-lamp high-power-factor ballast. Properly designed ballasts equipped with cutout starters and operating under favorable conditions—good ventilation and correct input voltage and frequency—should last indefinitely.

The test kit in Fig. 6 shows whether the trouble lies in the lamp. If a check shows the lamp is operating satisfactorily, next step is to test the starter. If neither of the tests proves positive, and if the electrical circuit is operating, the trouble must lie in the ballast. A simple test can be made by connecting the ballast in a bell-ringing circuit. If battery current is used, capacitive side of the circuit appears dead because of the condenser. If the circuit is closed, the bell should ring. This check only tests for completed circuits and cannot be relied upon where a short circuit is suspected. In any case, if the

(*Continued on page* 144)

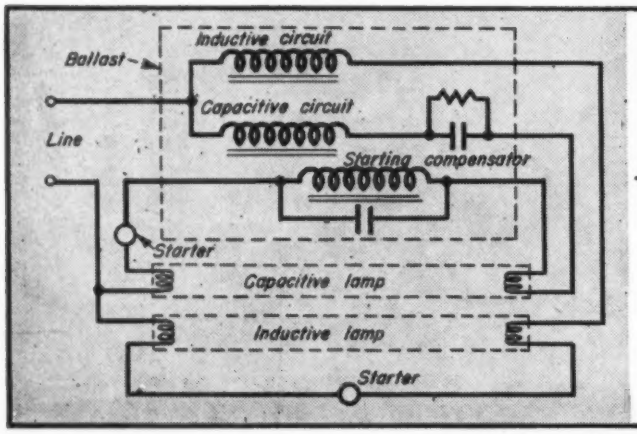


Fig. 5—Multiple-lamp fixtures contain both capacitive and inductive ballasts that make a high power factor unit

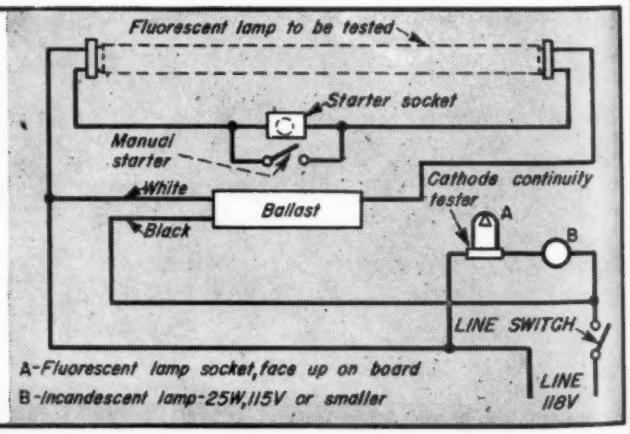


Fig. 6—Test board for checking fluorescent lamps and starters. Ballasts require a more complicated test set

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Eighteen Questions Answered For New Men in Refrigeration

Proper functioning of a refrigerating or air-conditioning system depends on how the component parts operate. Knowing the purpose of each device means faster trouble shooting, better repairs, fewer costly shutdowns, says J D Constance

Q 1—Name the different parts of a simple refrigeration system.

A—Compressor, discharge valve, oil trap, condenser, safety valves, receiver, expansion valve, evaporating coils, scale trap and suction valve.

Q 2—What purpose does a compressor serve in the refrigeration cycle?

A—Water is the usual medium that carries the absorbed heat away from the refrigeration system. But the temperature of available water is usually between 60 and 90 F. Since heat cannot flow uphill from the low-temperature evaporating coils, a mechanically driven compressor compresses the gas to a higher pressure, thereby concentrating the heat and raising the condensing temperature above that of the water used for condensing.

Q 3—Why is a valve placed in the compressor discharge line?

A—Such a valve isolates the compressor from rest of system so that the machine may be worked on without interference from the refrigerant.

Q 4—What is an oil separator?

A—It catches lubricating oil carried from the compressor. It is usually in the line between compressor and condenser to prevent oil being carried through the system where it might congeal and clog expansion valve or reduce heat transfer in the evaporating coils.

Q 5—What is a condenser's function?

A—Made to withstand high pressure, it is placed just downstream of the compressor to remove heat from hot compressed gas and condense it to a liquid to be used again in the evaporator. Cooling agent is usually water.

Q 6—What are safety valves, where are they placed and what is their purpose?

A—They are placed where pressures are highest, as at condenser and receiver. They relieve the system from excessively high pressure and thus prevent injury to personnel, equipment and property, if pressure exceeds a safe value. Each valve is set to blow at a predetermined pressure and the setting adjustment is sealed to prevent tampering.

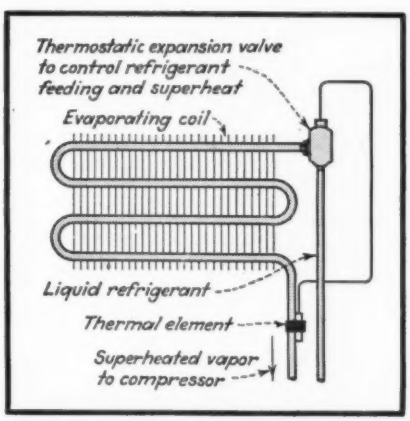


Fig. 1—Thermal element on suction line regulates the degree of superheat

Q 7—Why is a receiver placed just after the condenser?

A—To prevent condensed refrigerant building up in the condenser and reducing the water's cooling effect. When possible select a receiver large enough to hold entire refrigerant charge. This insures a drained condenser and provides a place to store refrigerant when system is pumped down for repairs.

Q 8—Describe an expansion valve.

A—A valve with a restricted opening, between receiver and evaporator, it sprays refrigerant as a jet into evaporating coils. It controls the cooling-coil pressure, which determines refrigerant temperature there.

Q 9—Why does a thermostatic expansion valve have a feeler bulb thermal element strapped to suction line adjacent to the evaporator?

A—This device, Fig. 1, insures passage of superheated vapor to compressor suction. It prevents liquid-refrigerant slugs getting to compressor.

Q 10—What is evaporator's function?

A—Here liquid refrigerant, coming from receiver, boils and in doing so absorbs heat from its surroundings. In turn, objects in the refrigerated room lose heat to boiling refrigerant.

Q 11—What is a scale trap? Where and why is it placed in the system?

A—It is a receptacle with strainer or screen to catch scale and dirt. Placed in the suction line it prevents foreign

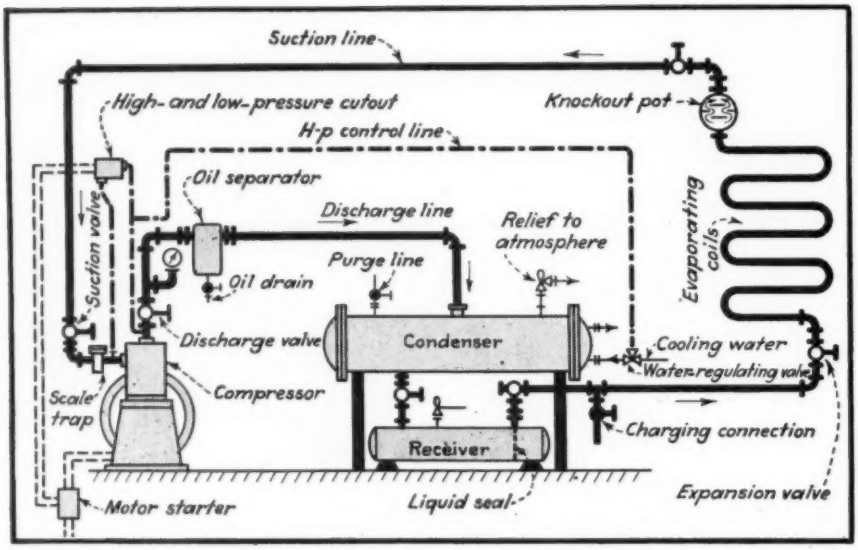


Fig. 2—Put charging connection in liquid line near the receiver to minimize danger of liquid slugs reaching the compressor during charging operation

particles getting into the compressor to clog valves or score cylinders.

Q 12—What is suction valve's purpose?

A—It isolates the compressor from the system's low-pressure or suction side. When pumping down, this valve is left open until all refrigerant is evacuated from low side. Then it is closed.

Q 13—What is a water-regulating valve and where is it placed?

A—A valve actuated by compressor discharge pressure is placed on the water inlet to regulate amount of water entering condenser according to variation of discharge pressure. When it rises, the valve opens to admit more water; conversely, on a pressure drop, the valve closes enough to bring pressure to normal by reducing water flow.

Q 14—Why is a high-pressure low-pressure cutout necessary?

A—It protects compressor against high-discharge and low-suction pressures. It consists of an electrical relay that opens the motor circuit. Pressure setting is adjusted in the field.

Q 15—Why is a purge connection placed on the condenser?

A—Non-condensable gas reduces condenser efficiency. The purge connection vents the condenser and exhausts this gas.

Q 16—Why is a knock-out pot sometimes installed just downstream from the evaporating coils?

A—It separates and removes liquid-refrigerant droplets from suction gas.

Q 17—Why is the charging connection put on the system's high-pressure side?

A—Charging on the low side may damage the compressor because slugs of liquid would surely find their way to the compressor suction. Connection in Fig. 2 is close to the receiver where refrigerant may be stored at once. Thus liquid slugs do not reach compressor.

Q 18—What is a 2-temperature refrigeration installation? Name its important parts and tell how it operates.

A—Two refrigeration loads, Fig. 3, supplied from a single condensing unit, can use a 2-temperature valve that permits operating the cooling units at different temperatures.

Principle of operation is: Two-temperature valve (T) snaps shut when evaporating pressure in high-temperature cooling coil (H) falls to a predetermined low point. Condensing unit (C) continues to run on low-temperature cooling coil (L) until suction-pressure control switch (S) stops it. After 2-temperature valve (T) closes, refrigerant trapped in high-temperature cooler (H) continues to evaporate, thereby increasing internal pressure. Continued pressure increase again causes valve (T) to snap wide open, and accumulated gas in coil (H) then flows to condensing unit.

If this action occurs while condensing unit is stopped by low-pressure control switch (S), volume of gas from coil (H) gradually increases suction pressures enough to close control switch (S). Condensing unit then runs on the high-temperature coil until pressure in that coil falls to the cutoff setting of the 2-temperature valve, and valve again snaps shut. Check valve on low-temperature coil opens when pressure in main suction line falls below that in the coil. Condensing unit then operates on low-temperature coil until stopped by suction-pressure control. The cycle repeats to meet requirements.

The same condensing unit serves two or more refrigerating loads provided the unit selected has sufficient capacity to handle entire load at the lower suction pressure. Load on the high-temperature cooling coil must be within the capacity of the 2-temperature valve to which it is connected.

Two-temperature snap-action control valve is not a constant back-pressure device. It is either wide open or shut, and controls the high-temperature coil the same as the suction-pressure switch controls the remainder of the system.

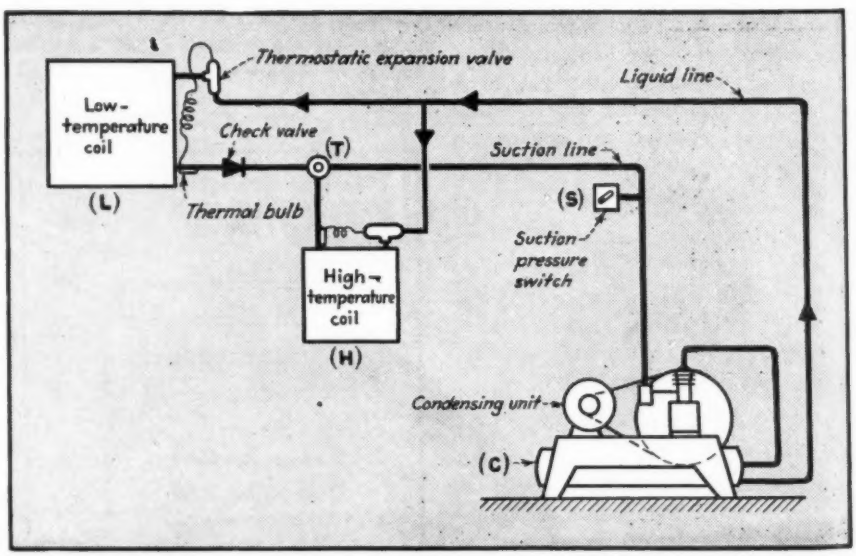


Fig. 3—A 2-temperature valve, check valve and suction-pressure switch permit one condensing unit to supply two different-temperature refrigeration loads

Condenser With Cracked Tail Pipe Passes Water Into Exhaust Line

Can water be taken over from an injector condenser into engine or turbine exhaust line? C B Hudson answers this often discussed question from his recent experience, which shows that some water enters the exhaust if a tail pipe is cracked near the bottom and cannot carry away the full flow

▶ HERE'S HOW our plant traced a heavy flow of water at the exhaust drain to a cracked injector condenser.

Fig. 1 shows the piping for a 52-in. injector condenser that serves our 2000-kw turbine. Cooling water is supplied by a turbine-driven centrifugal pump discharging into a vertical cast-iron tank that vents to atmosphere through a small pipe extending above the condenser head. A valve in the large pipe between tank and condenser head regulates cooling-water flow.

Condenser design is such that it is not possible to supply more water than will pass through the tail pipe, thus removing the possibility of cooling water being forced over into the turbine exhaust pipe under normal conditions. Water jet removes noncondensable gas and no vacuum pump is provided.

The condenser had been out of service several weeks for turbine overhaul and upon completion of the work we attempted to raise the vacuum for a trial run. When the vacuum reached about 15 in., the mercury column began to bounce up and down and within a short time gradually settled back to zero.

Oiler Reports Noise

After this happened two or three times the oiler reported that while passing the condenser on his way back from inspecting the pump he heard a "whooshing" sound near the condenser hotwell. Investigation disclosed a crack in the condenser tail pipe over 5 ft long, which had opened up more than a quarter of an inch at the widest spot, *B*. At the same time a heavy flow of water was discovered at the atmospheric exhaust drain.

A test proved this to be salt water. It was at once apparent that when the vacuum reached about 15 in., sufficient air flowed in through the crack to act as an air lift and carry slugs of water up the tail pipe, through the condenser head and into the turbine exhaust pipe. When enough air entered, the vacuum dropped to zero and the process was repeated. The crack was not discovered previously because the condenser stands outside the engine room close to the wall and the fault occurred on the side nearest the wall.

Since the turbine was urgently needed it was imperative that the condenser be repaired in the shortest possible time. Two strips of diaphragm packing, ¼ in. thick, by 10 in. wide, cut from 36-in. wide material were held in place by two strips of 1-in. angle iron, placed near the edge of the packing as illustrated at *A* (left side of sketch).

A plastic compound was smeared on the pipe under the packing edge and all held in place by ⅜-in. capscrews on 4-in. centers, the cast-iron tail pipe having been drilled and tapped to receive them. Repairs were completed in a few hours. The condenser was immediately put in service, and a vacuum within 1 in. of the barometer reading secured. Since then we have at one time secured a 29.3-in. vacuum with a 30-in. barometer reading.

Had the tail pipe cracked with turbine in operation it is probable that water would have flowed over into the turbine since it is but a few feet above the atmospheric relief valve. I have had charge of this condenser for the past 25 years and this is the first time water has flowed over into the exhaust pipe.

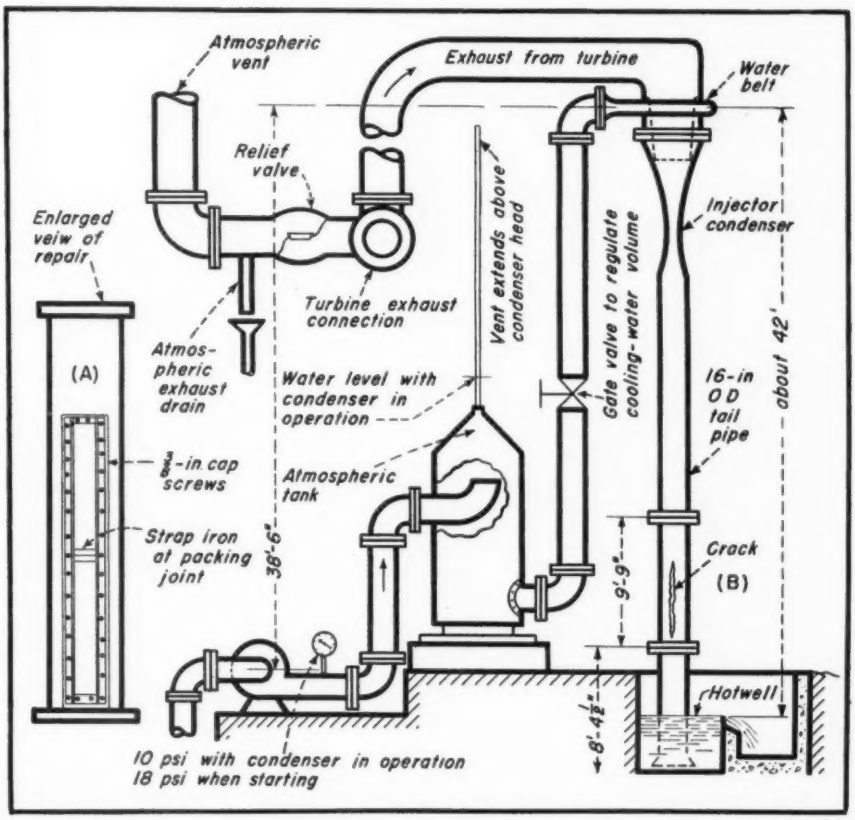
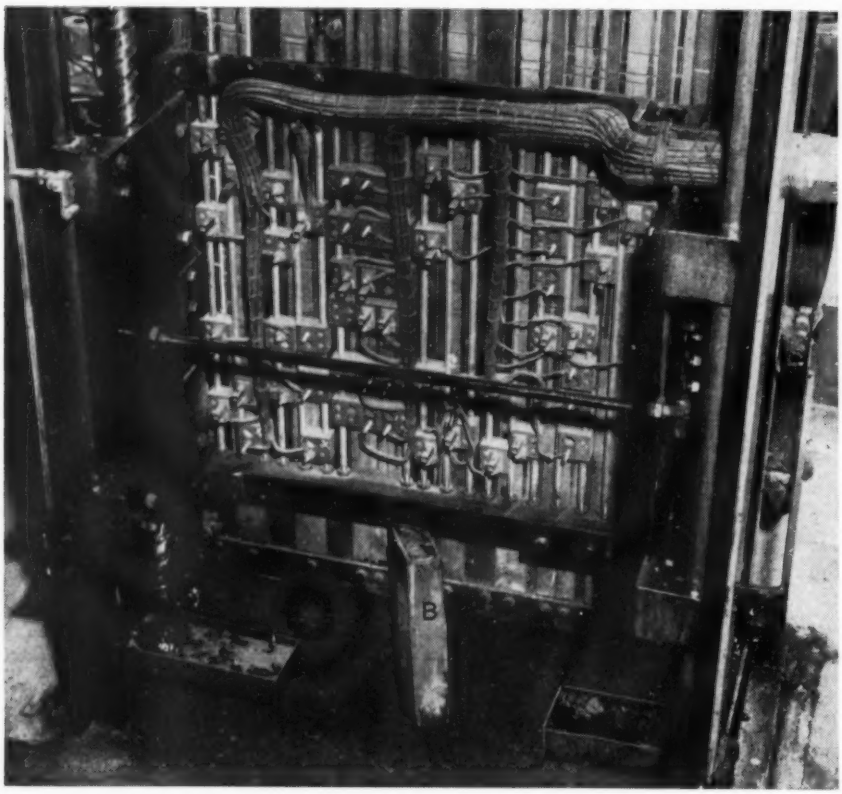


Fig. 1—Inspection disclosed a crack over 5 ft long and a quarter-inch wide in condenser tail pipe. Diaphragm packing and angle iron repaired the break

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



WOOD BLOCK CORRECTS ELEVATOR SELECTOR

ON AN AUTOMATIC ELEVATOR the floor selector's position must be corrected when the car goes to the top or the bottom landing to compensate for slip of the hoist cables on the traction sheave. On the elevators in the McGraw-Hill Publishing Co's building this is done by limit nuts on the screws that drive the selector brush carriages.

Our service elevator runs from the top floor to the basement, but during the day it is used for express passenger service from the ground to the top floor. When in passenger service, the car does not go to the basement to correct the bottom position of the selector. We have taken care of this condition by cutting a wood block, *B* in the photo, that just fits between the selector and the control-room floor when the car is at the ground floor.

If the selector is a little ahead of the car at the ground floor it lands on the block and is stopped. Since the screws cannot drive it any farther, the clutch in their driving mechanism slips to correct the selector's position to that of the car.

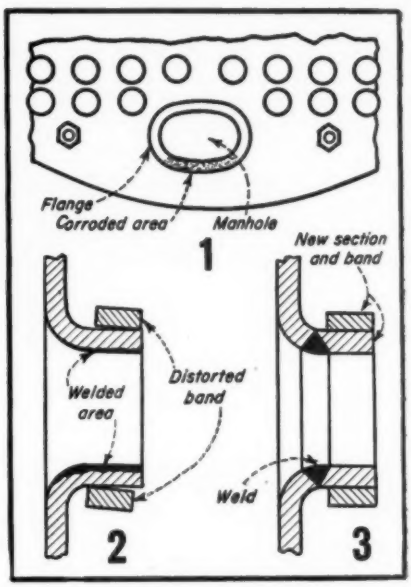
When the block is under the selector the car cannot go to the basement without slipping its driving clutch, in which case the selector would be one floor out of position. If during the day it becomes necessary to take the car to the basement, which is seldom, the starter calls the control room to have the block removed. When the car returns to the ground floor we replace the block. When the car goes into night, weekend or holiday service, the block is removed and is not replaced until the car goes back into day express operation. This arrangement has worked satisfactorily and the selector's position is always corrected at the limits of car travel.

New York, N. Y. FRANK SCHLIEFF

Improper Welding Leads To Costly Repair Job

BECAUSE OF GASKET LEAKAGE, the bottom side of a manhole became badly corroded in the front head of an hrt boiler, Fig. 1 and 2. The engineer recommended that the corroded area be built up to its original thickness by welding, expecting a welder experienced in boiler repairs to do the work.

After the job was done it was found impossible to prevent leakage at the manhole-cover gasket. A check revealed that the repair had been made by a not-too-competent garage welder



who did the job with oxyacetylene welding. He generously applied welding metal over the entire flange up to the gasket seat, even allowing metal to spill over the seat. The flange's top was not corroded but the welder applied a coat of metal to this area for good measure. The high temperature of the flange caused by welding had badly twisted it and the ring that formed a seat of proper width for the gasket, Fig. 2.

An experienced boiler welder would have welded only the corroded area, using an electric arc applied with care to prevent overheating the flange. The damage was repaired by cutting off the

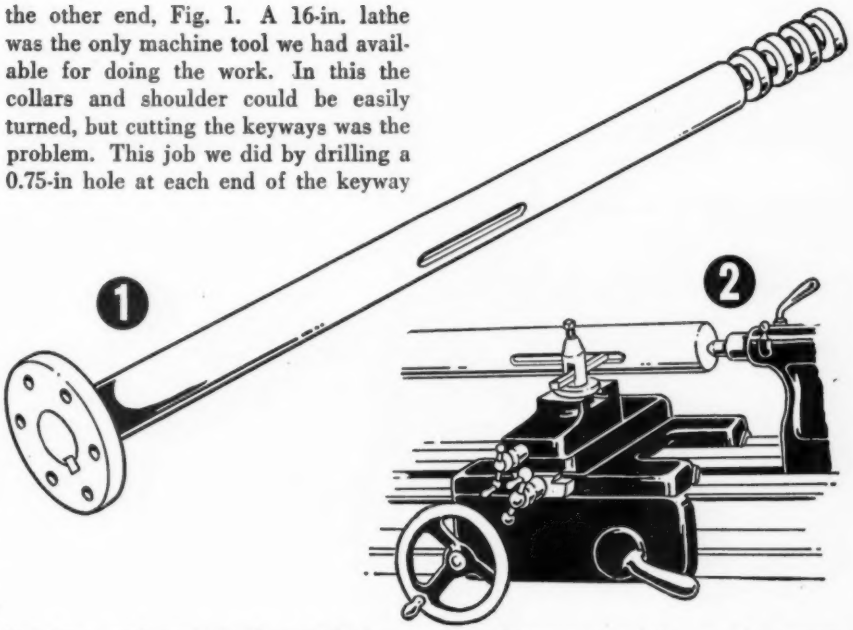
straight portion of the flange and electric welding on a new one by a single V-butt joint, Fig. 3. The elliptical-shaped ring was fabricated to provide a $\frac{1}{16}$-in. seat for the gasket joint.

Canton, Mass. HARRY M SPRING

Adapt Hoist Shaft to Circulating-Water Pump

WHEN THE SHAFT BROKE on a circulating-water pump we had to get the unit in service again as soon as possible. A new shaft was not available and could be obtained only on long-time delivery, so we had to produce one out of resourcefulness and material available. The only shafting that might be used in the pump was one in an old hoist. As it was the same size as that in the pump and had more than sufficient length we removed it from the hoist.

To fit the shaft to the pump we cut a shoulder and keyway at one end for the coupling, a keyway for the impeller and collars for the thrust bearing at the other end, Fig. 1. A 16-in. lathe was the only machine tool we had available for doing the work. In this the collars and shoulder could be easily turned, but cutting the keyways was the problem. This job we did by drilling a 0.75-in hole at each end of the keyway

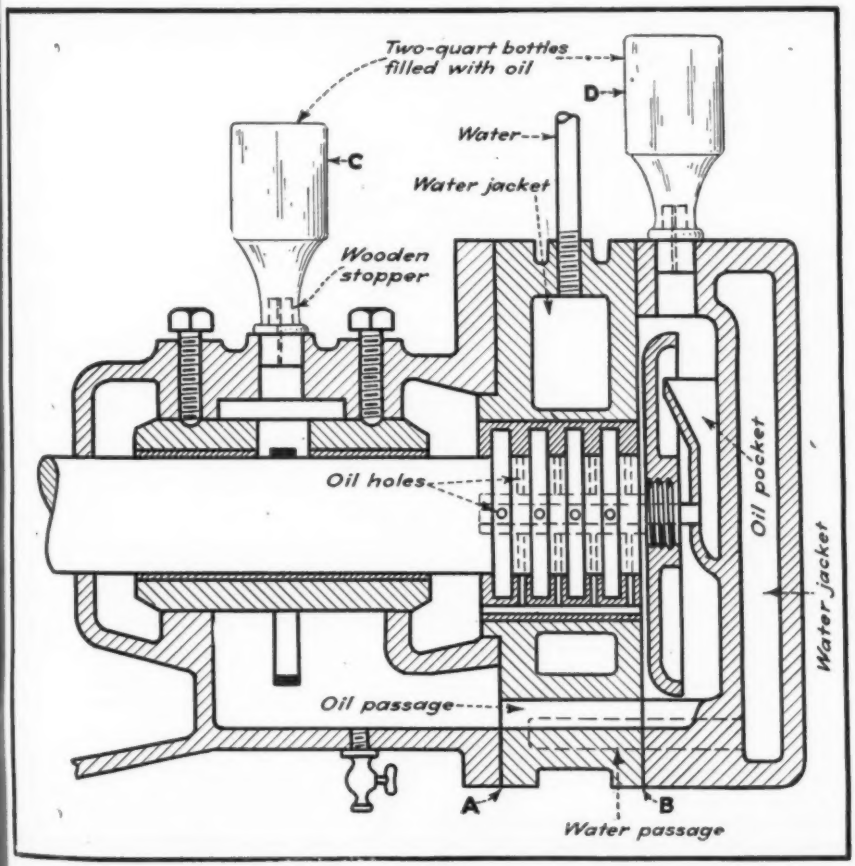


locations and putting the shaft in a lathe. Then, by turning the lathe tool sideways and running the carriage back and forth by hand we removed the metal from between the holes to the proper depth for the keys, Fig. 2. This slow 15-hr job put the pump back in service.

Flushing, N. Y. S M ELONKA

BOTTLE OILERS KEEP PUMP IN SERVICE

WE REPLACED the impeller in a 375-gpm 460-ft head 4-stage centrifugal pump to improve its operation. Like many other power-plant jobs this one had to be done on Sunday. After the pump had operated about 3 hr I discovered that thrust-bearing gaskets *A* and *B* (see drawing) had not been renewed. Because of this, bearing cooling water was leaking by gasket *B* into the oil chamber. To have shut down the pump and renewed the gasket would have cost about $3000 in production besides requiring a lot of unpleasant explanations.



We kept the pump running 24 hr per day for a week by the use of two 2-quart bottles filled with oil. In each bottle we placed a wooden stopper with a hole drilled through it for the oil to drip out. One of the bottles, *C*, we turned upside down with its stopper in the oil hole over the sleeve-bearing oil ring and let the oil drip on the ring and shaft.

The stopper of the other bottle, *D*, we placed in the oil hole above the thrust-bearing oil pocket. Oil dripping into this pocket flowed through a hole in the center of the shaft and holes in the thrust rings to lubricate this bearing. We also removed the petcock from the bottom of the oil chamber to let the water and oil run to waste.

We made the hole size in the stoppers to suit what we thought was the required oil flow. This worked out so that the bottle of oil on the sleeve bearing lasted about three days and the one on the thrust bearing 24 hr. Each hole was about $\frac{3}{16}$ in. in diameter. When

the gaskets were renewed after a 156-hr run the bearings were in fine condition, showing that they had been well lubricated.

Thorold, Ont. G BARRETT

Don't Lock Up Pipe Expansion

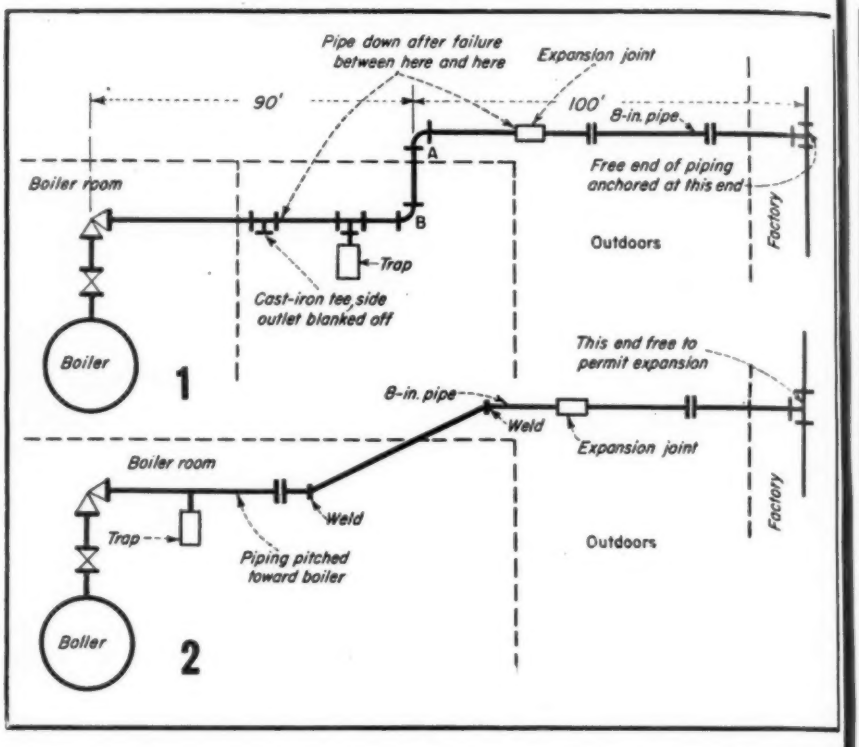
A RECENT STEAM-LINE FAILURE emphasizes the need for competent supervision of important alterations to such piping. This line was relocated during building alterations, and made a 90-ft and a 100-ft run after leaving the boiler, Fig. 1. To relieve expansion stresses in the line a slip-type expansion joint was installed in the 100-ft pipe run. Unfortunately, inexperienced workmen not properly supervised did the job, and the line was not checked after completion by an engineer.

When steam was first admitted to the line, movement was discovered in the pipe inside the factory wall. Workmen expecting the expansion joint to take this movement, rigidly anchored the pipe's free end. Steam pressure was then increased to 100 psi in the pipe when after a few minutes it failed at the two cast-iron elbows, *A* and *B*. The failure pulled the expansion joint apart, throwing sections of pipe through the roof and causing extensive damage.

Investigation showed that the expansion joint had been installed in the closed position, which left no clearance to take care of pipe expansion. When the pipe's free end was anchored, severe bending stresses in cast-iron fittings *A* and *B* caused their failure. Probably initial failure occurred in the elbows followed by failure of the expansion joint and the tee due to reaction stresses. Following repairs of damage to the building the pipeline was reinstalled, as in Fig. 2.

As a matter of interest calculations for the magnitude of expansion and the stresses resulting from completely restricted expansion showed that for a temperature range from 60 to 338 F (temperatures of steam at 100 psi) the pipe if free would expand about 4⅜ in. Completely restricting this expansion would put a total stress in the pipe of 430,000 lb, or 52,403 psi. Resolving a portion of this load into bending stresses in the cast-iron fittings, in which 2000 psi is a safe limit, it is not difficult to see why the pipe failed.

Canton, Mass. HARRY M SPRING

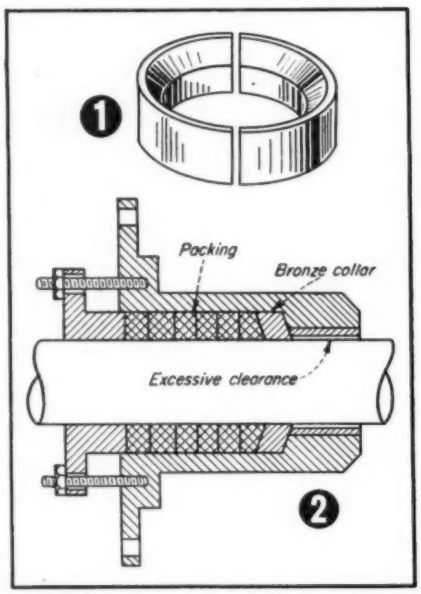


Collar Holds Packing In Stuffing Box

BECAUSE OF EXCESSIVE CLEARANCE between the worm shaft and its throat bushing the packing gradually pushed through from the stuffing box into the gear case of an elevator machine. To correct this condition I made a brass collar that fitted with a close clearance around the shaft and in the stuffing box.

I made this collar from a section cut from a bronze bushing with an outside diameter larger than the inside diameter of the stuffing box. I first cut this section in two longitudinally, ground these faces to a good fit and soldered them together.

From this 2-part ring I machined the collar to fit on the shaft and in the stuffing box. After machining, the collar was heated to melt the solder so that its two halves could be separated, as in Fig. 1, after which the collar was installed in the stuffing box, as in Fig. 2.



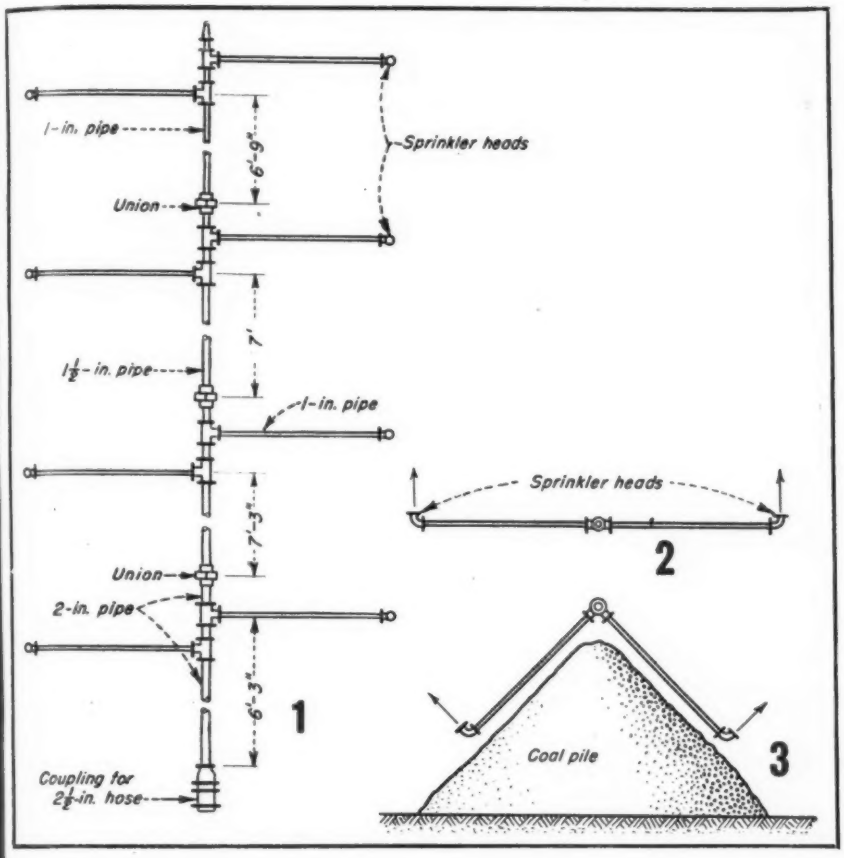
Since installing the collar we have had no trouble with the packing, where before putting in the collar the packing failed in a short time.

Englewood, N. J. R BOETTINGER

Portable Sprinkler Kills Coal-Pile Fires

CONTROL of coal-pile fires becomes increasingly important at this time because of the quality of coal we must now use and the larger quantities stored for winter use. Frequently to increase the coal supply the purchasing department picks up unallocated or rejected coal that adds to the fire-prevention problem in the storage pile.

We have developed a method for extinguishing coal-pile fires using sprinkler heads on a portable header, Fig. 1. The sprinkler heads can be turned flat, Fig. 2. or swung down over the coal pile if it is peaked, Fig. 3, next page.



We found the fire hose unsatisfactory for handling coal-pile fires. The hose stream is too large, has too much force, and often causes the fire pockets to arch over with coke that prevents water reaching the fire. The fire could be entirely or partly extinguished, but the heat was not all removed, which would cause re-ignition. We believe that rapidly quenching a coal-pile fire with water from a hose generates a low-grade producer gas that tends to aggravate and prolong the fire.

Sprinkler heads apply the water at a lower rate to the coal pile than does a hose. This gives it a chance to percolate slowly through the whole pile, quenching the fire and carrying away the heat. We allow the water to discharge from the sprinkler heads for several hours, but the total consumption is less than from a fire hose. This method makes a hit with the firemen because they do not have to apply a fire-hose stream to the coal pile for hours in all kinds of weather.

We made one sprinkler-head equipment like that in Fig. 1 and a short one to take care of spot fires that were not readily extinguished by an application of the larger unit. Either the large or small equipment is easily moved on the coal pile and connected to a fire hose. This equipment has been in use since last fall and no fires have re-ignited after being extinguished. If re-ignition should occur it can be taken care of promptly at the first signs of heat.

JAS H DAVIDSON AND FRANK ELWELL
Buick Motor Division
General Motors Corp, Flint, Mich.

Vacuum Gage Adapted to Measure Liquid Level

I NEEDED A MEANS of indicating in our boiler room the liquid level in a tank outside the plant. Measurements showed that liquid level in the tank when full was about 25 ft above a convenient level at which to install the indicator in the boiler room. This head was well within the limits of an old differential vacuum and pressure gage that we had in the store room, so we adapted it to the job.

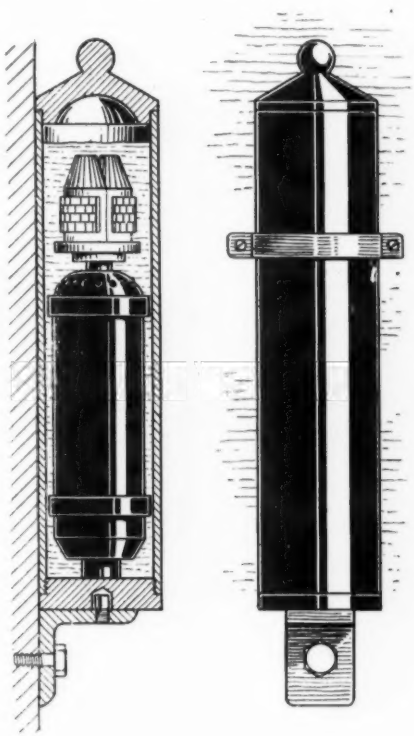
To do this, we installed and connected the gage to the discharge line from the tank. We placed a petcock at the gage to drain off any air that might collect in its connecting pipe. When the tank was full we removed the gage pointer and set it at zero so that as the level dropped in the tank the gage pointer moved back across the vacuum scale. By putting level values on the scale corresponding to different measured levels in the tank, we could read the liquid level directly.

London, O. F W SCHNEIDER

Boiler-Tube Makes Tube-Turbine Container

BOILER-TUBE TURBINES may remain around the plant for long periods without being used. During these periods, if they are not properly protected they are subjected to dirt and corrosive fumes that may seriously damage their parts. To insure that our boiler-tube turbine is properly protected I made a casing for it from a section of old boiler tube, as in the drawings, below.

I threaded the inside of one end of the tube and made a metal plug to thread tightly in this end. From a piece of old cast iron I made a snug-fitting



cover for the other end, as shown. A piece of angle iron with a short pin threaded in it and bolted on the wall provided support for the container. A hole bored part way through its base permitted the container to be readily centered on its support and held there by a strap.

After the turbine is put in its container we fill the latter with kerosene, and check its level periodically. Even if the kerosene is not replenished the tight-fitting cover on the container protects the turbine from dust and fumes.

Flushing, N. Y. S M ELONKA

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions From Our Readers

1—Will a Larger Evaporator Do the Job?

WE USE a flooded evaporator, complete with accumulator, to refrigerate our storeroom. As originally installed it was comparatively simple to maintain a room temperature of 15 F with 20-psig suction pressure (Ammonia is the refrigerant.).

Recently we have begun storing more produce but find that we cannot handle much increased volume. Instead of one, I operate both the main and standby compressors on the evaporator, pulling the suction pressure down to 10 psig, which just maintains 15 F in the room and permits a slight increase in storage capacity. Normally one compressor operates intermittently.

Operating this way is asking for trouble because if one compressor fails a considerable quantity of produce may spoil. Also, the low suction pressure is increasing the cost per ton of refrigeration. What benefits, if any, would come from installing (1) a liquid-gas heat exchanger to sub-cool the refrigerant and (2) additional heat-transfer surface in the present evaporator (pipes now arranged along one wall)? How should this extra piping be connected into the present system?

Since one compressor running half the time carried the load of one evaporator, will it take care of an additional evaporator if both absorb enough heat to give a suction pressure of 20 psig? Will it be necessary to increase the compressor speed, or must both units operate? How should the liquid-gas heat exchanger be connected?—*GAR*

2—Can Breeching Serve As Air Preheater?

UPTAKE BREECHING from the boilers in my plant has an unobstructed run before it enters the stack, and space is available to install an additional duct. I want to know if it is practicable to install an air-intake duct around the breeching, connecting it to the stoker blower inlet so that combustion air will be preheated before it enters the furnace.

What do POWER readers think of this idea? How would they design and arrange the intake opening? Will this cooling action on the exit gas affect natural draft on the furnace?—*JAJ*

Answers to August Questions

What Happens To the Water Level?

(This is Question 1 from the August issue, with best answers from readers.)

STEAM FOR PROCESS WORK *at a local plant is supplied by three 250-hp straight-tube boilers. Local water is considered good, containing only 2 to 2½ grains per gal hardness. There is no trouble with priming in other boilers in this city nor any scale accumulation worth mentioning.*

Water columns on these boilers, sketch Q-1, have always given trouble. Each time after the gage glass or water column is blown down the water rises to the top of the glass. It falls slowly, usually taking 15 to 20 min to reach normal level (normal is 4 in. in the glass).

A year ago, the second lower water-column connection was installed against my recommendation. Pipes, fittings and valves were renewed to assure that no stoppages existed. Upper-column connection is fitted at right angles to the drum as shown. After the change conditions remained as before.

Steam leaving the boiler passes over the baffle top to a separator before reaching the outlet. Is there enough turbulence in this area to create a pressure drop at the water-column connections and unbalance the water level? Would moving the upper connection outside this area correct the trouble? Does upflow in the header affect water flow in the lower connection?—ABQ

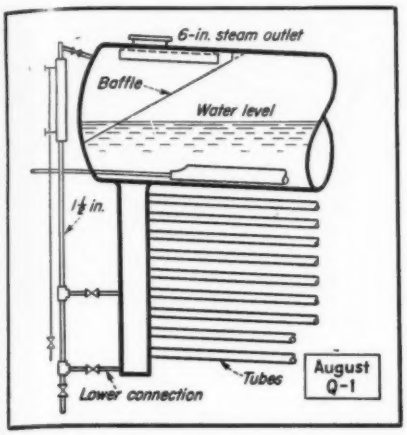
Boiler Circulation Causes False Level

THE WATER COLUMN shown in August Q-1 is incorrectly connected. According to the ASME Code the water connection should be taken from a point not less than 6 in. below the center line of the shell (ASME Code, Par 320-322). In this installation the water connection is made on the steam header. Natural circulation in the boiler causes impingement on the water connection, which results in the water rushing to the top whenever the column is blown down. When this correction is made, *ABQ* will probably find that the water-column level now indicated is higher than the actual water level in the boiler.

Rahway, N. J. B J DI SANTO

Had Similar Experience

MANY YEARS AGO, when I was engineer on a steamer, I had exactly the same experience with two Scotch marine boil-



ers. Lack of circulation in the lower connecting pipe causes the false reading. Also, this pipe is exposed to outside temperature, thus reducing the water temperature, which causes false water-level indication. The level shown immediately after the gage glass is blown is the correct level in the boiler.

To overcome the trouble, *ABQ* should connect the lower pipe of the gage column directly into the boiler drum, and it will give the true water level at all times.

Seattle, Wash. J Q OSBORNE

Column Never Indicates Accurately

THE ANSWER to the odd water-column indication is that the lower connection is taken off the vertical headers into which the steam generating tubes discharge. With this setup the water column not only indicates the pressure difference forcing steam around the drum baffle, but also the pressure difference forcing the steam-water mixture up into the drum through the vertical headers.

These indications are in addition to the actual water level in the drum. Therefore the column never does give an accurate indication of the water level. The lower-column connection should be tied into the drum itself, or as close to it as possible. If it must be connected to the vertical header, it should have some sort of baffle arrangement on the lower connection so that the water-steam mixture does not impinge on it and give a false high reading.

If the top gage-glass ball check is not causing the trouble by sticking in the closed position, I believe cooling the water in the long lower leg may account for the gradual drop in the gage-glass level after blowing down. However, the boiler pressure and distance between connections would have to be known to calculate the difference in water densities at room and boiler temperature to see if cooling causes the drop.

Glenview, Ill. R H MCKANE

Last Connection Made Conditions Worse

IT SEEMS TO ME that the original lower water-column connection was bad enough without making the condition worse by installing another connection at the bottom of the header as illustrated.

Pressure in the lower tubes is slightly greater than that in the drum, therefore an unbalanced condition does exist immediately after blowing down the column.

The upper-column connection, baffle and dry pipe appear to be conventional design and I do not believe the trouble lies there.

Changing the lower connection from the bottom of the header, to the head of the drum, about 6 in. from the bottom, will cure the trouble.

Bogota, N. J. FRED MEYER

Consult Boiler Code

IF THE SKETCH, August Q-1, is correct I do not understand why the boiler inspector or consulting engineer did not condemn the connection. Boiler drums usually have openings for water-column connections so it seems odd that the lower pipe was not connected to the drum, sketch 1-A.

I suggest that *ABQ* consult manufacturers' bulletins and the ASME Boiler Code (par 293) to learn the recommended methods of connecting a water column.

The dry pipe is necessary and follows good practice, but I do not believe the baffle is installed correctly. If *ABQ* can maintain full boiler pressure and produce the required amount of steam the trouble must be in the water column.

Philadelphia, Pa. W. T. MULLEN

Pipe to Common Blowdown Line

ABQ'S WATER COLUMN appears to be installed incorrectly, or he has an automatic and chain control offset-cylindrical water gage that gives trouble if not blown correctly. Some years ago when I took over a new plant I found the water columns installed like *ABQ's*.

Leaving the lower connection as installed, I corrected the trouble by connecting the gage-glass blowdown line into the water-column blowdown just below its discharge valve. A valve below the connection served as a common blowdown for both the glass and water column. When blowing down we opened the common valve first, and next the valves in the glass and column lines. Common valve was then closed first.

Oaklyn, N. J. C A WILKES

Water in Column Leg Cools Down

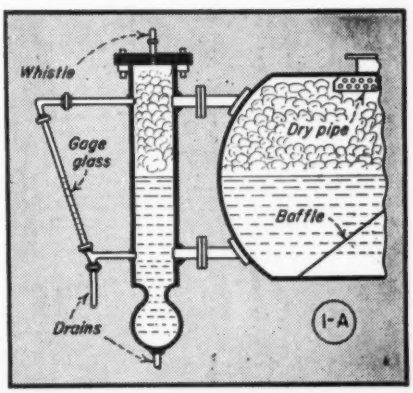
IF WATER-COLUMN PIPING and fittings have been renewed the possible point of obstruction is a sticking ball check in the gage-glass fitting.

Pressure differential across the boiler-drum baffle may affect the gage-glass level, but this disturbance would be continuous rather than intermittent. The same is true if the gage indication is affected by steam bubbles and water rising through the tube headers.

Boiler circulation and drum baffle may affect the gage reading to some extent but I believe most of the trouble arises from a difference in temperature between the boiler water and that in the water column. Thus the gage glass indicates the correct boiler-water level immediately after the column is blown down because water in the column contains some steam bubbles and is at the same temperature as the boiler water.

After standing for 15 to 20 min water in the column leg loses its steam bubbles and also gets considerably colder than the boiler water. Thus being heavier, the cooler water in the column, even though showing a lower level, still balances the original level in the boiler. Installing the lower connection only aggravated the condition because it made the water leg (subjected to cooling action) longer.

Assuming as correct the statement that water level goes to top of gage glass immediately after blowing down and then falls to 4 in. after a time interval, *ABQ* will find that if he maintains 4 in. of water in the gage glass the level inside the drum will be almost up to



or perhaps level with the dry pipe.

I suggest that the lower connection of water column be fed directly from the boiler drum. *ABQ* can learn the effect of temperature differential in a water column by connecting a second water column directly to the drum and comparing its indicated level with that in the original column.

New York, N. Y. L C RINEHART

Change Both Water Column Connections

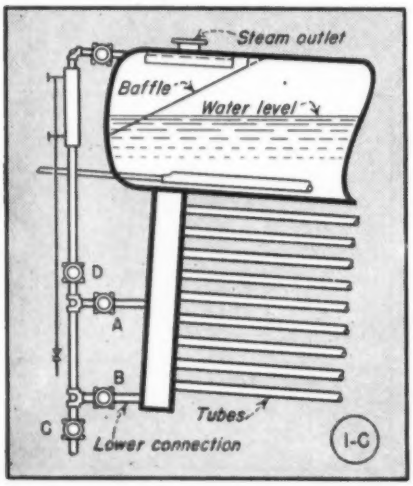
WATER COLUMN is not installed properly because the steam pipe should connect to the drum top, and water line to a low point in the drum. If in doubt *ABQ* should consult an engineering textbook, a reputable consulting engineer, or the water-column manufacturer. Changing the connections as suggested should cure the false water-level indication. I have seen many watertube boiler installations but have yet to see a water column connected as shown in the sketch.

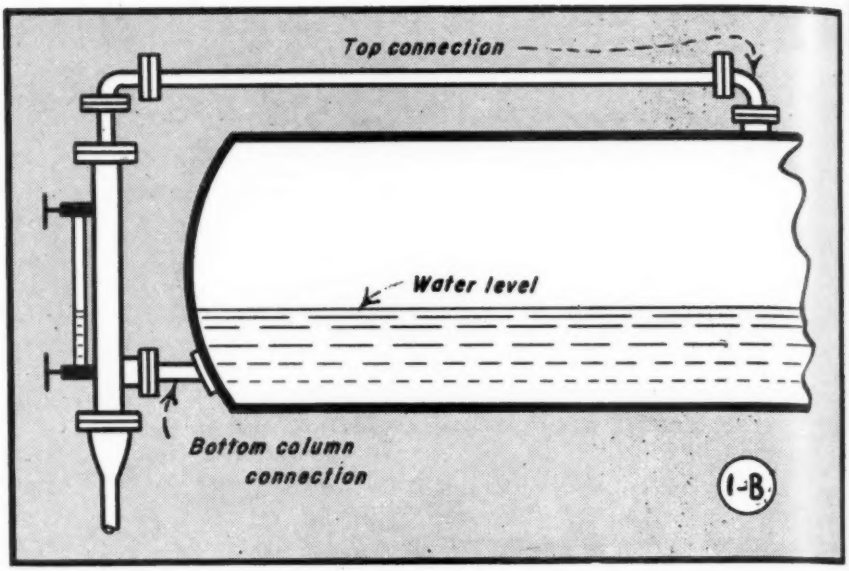
Philadelphia, Pa. T F CUNNINGHAM

Steam Bubbles Enter Gage Piping

I THINK *ABQ's* trouble results largely from the way the water column is connected. Circulation in this boiler is from the back header, through the tubes to the front header, and up to the drum. Greatest agitation occurs at front half of the tube bank. Water in the front header contains thousands of steam bubbles that are rushing to reach the surface where they will be liberated. It is not good practice to place the water-column connection on the header.

Sketch 1-B shows a good way to pipe a water column on this type of boiler. Top connection should be at least 40 in.





from the head towards the center of the boiler, and taken from the highest point of the drum. Most manufacturers locate flanges for these connections. Bottom connection should be made vertically below the drum center and high enough not to interfere with the head flange.

If *ABQ* follows this plan his water-level trouble will disappear.

W. Duluth, Minn. E R WEBBER

Connect Lower Pipe To Boiler Drum

WHEN *ABQ* OPENS THE BLOWDOWN, water in the gage glass is slightly depressed according to the hydraulic gradient between the drum and blowdown discharge. When the valve is suddenly shut, the gradient no longer exists, and the kinetic energy of the water in the blowdown line is changed to potential energy. This causes a surge of the water level in the gage glass.

If the lower gage-glass connections were on the lower half of the drum, and disconnected from the boiler below, he would have no trouble. With the present arrangement, water passing through the tubes is forced against the opposite side of the header where the gage-glass connection is located. Impact of the water causes the gage level to remain above the water level in the drum.

Either one of the following solutions, sketch 1-C, will remedy the condition: (1) Close valve *C* slowly to prevent a sudden surge of the water level. (2) Keep valve *A* shut while blowing down. (3) Add valve *D*, and keep it shut while blowing down.

ANTONIO DI LORENZO
W. New York, N. J.

Water Becomes Denser As It Cools

DIFFICULTY IS CAUSED by a difference in temperature between water in the boiler and that in the long leg on the water column. Immediately after blowing down the column the return water is at the same temperature as that in the boiler. As it cools it becomes denser and consequently indicates lower level. Further, *ABQ* will probably find that the true water level is indicated by the high level shown just after blowing down the glass. Taking the lower water-leg connection from a point as near the normal water level as practical (in the drum is best) will undoubtedly solve his difficulty.

Baton Rouge, La. J T O'BRIEN

Pressure Drop Across Baffle Affects Level

TROUBLE with the water level in *ABQ's* boiler appears to be caused by pressure drop around the boiler-drum baffle.

Simplest and most reliable arrangement is to connect both lines so there is no obstruction in the drum between them. Water-column connections to the drum should also be clear of tube headers and outlet nozzles because the flow through these parts may affect the level indications, especially when the boiler runs at high rating.

Piney River, Va. I A BUTCHER

Computes Difference In Water Weight

WATER-COLUMN CONNECTIONS should be made to the boiler drum, keeping them as short as possible and using pipe tees instead of ells so the lines can be

cleaned. The second lower tap was a mistake because this sets up constant circulation through the two lower connections, which tends to give a false gage reading.

Trouble with the present arrangement is that water in the long leg gradually cools to room temperature. As it cools it becomes heavier and drops in the glass. After the water column is blown down it fills with hot water and indicates a higher but true level.

ABQ can figure how much higher the boiler water level is than that shown by the gage glass as follows: (1) Measure the distance from gage-glass water level to the bottom connection. (2) Multiply this distance by the weight of water at room temperature. (3) Divide by the weight of water at boiler temperature. (4) Subtract the original distance. Remainder is the difference between water levels.

Assume a boiler operates at 150 psi and the water-column bottom leg is connected to the boiler 6 ft below water level. Water weighs 55.2 lb per cu ft at a temperature corresponding to 150 psi, and 62.1 lb at 90 F. Then:

$$\frac{6 \times 62.1}{55.2}$$

= 6.75, and 6.75 − 6.00 = 0.75 ft, or 9 in., the difference in water levels.

Omaha, Neb. PAUL WARD

Is This Heater Operation Safe?

(This is Question 2 from the August issue, with best answers from readers.)

Our hot-water coils supplied with steam at 2- to 10-psi pressure have failed for the third time. Holes in them are ½ in. in diameter. The local plumber, who soldered the leaks last year, does not have time to help us out and we are unable to secure coils.

To keep the unit in service I have reduced the water pressure to 15 psi and raised the steam pressure to 40 psi. Consequently, instead of water leaking into the coils live steam enters the water. Although it creates some disturbance we have plenty of hot water at no noticeable increase in fuel cost.

Will water in the tank boil at 212 F or at a temperature corresponding to the water pressure? If water temperature increases above 212 F will it do any harm? With the system absolutely tight what maximum pressure can build up in the tank by the 40-psi steam, reduced from 100 psi, having contact with the water?—PAH

Braze Patches Over the Holes

INSTEAD OF SOLDERING the holes in the heating coil *PAH* should cut and split copper tubing into 1-in. lengths and use these to patch the leaks, sketch 2-A. If the coils contain many large holes, best solution is to have a new set fabricated in a shop specializing in this sort of work.

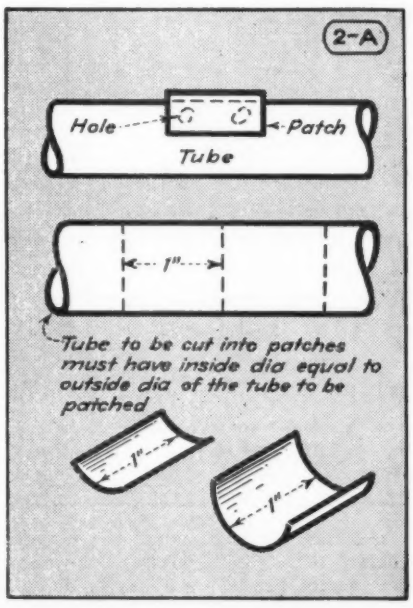
With the present arrangement how can water under 15-psi pressure enter if 40-psi steam is applied directly to the tank? Naturally there is some pressure drop in the coils but I would not expect 25 psi. Also the safety factor is reduced by increasing the steam pressure from 10 to 40 psi. Relief valve must be reset for this pressure.

Philadelphia, Pa. W T MULLEN

Repair Coils Without Delay

BASED ON THE DATA SUBMITTED, it is difficult to say whether the operation is safe. However, if the water is for washroom service, operation is definitely unsafe. With the system absolutely tight the pressure could build up to 40 psi in the tank. With perfect insulation, tank temperature could reach 298 F, or the temperature of saturated steam at 40 psi. In other words, the water tank would act as an accumulator and flashing would result as soon as water was released. Furthermore, unless a satisfactory relief valve is incorporated in the steam line, the pressure might reach 100 psi. *PAH* should repair the coils and install a safety valve to relieve the tank pressure in case of a leak or break in the coils.

Rahway, N. J. B J DI SANTO



Protect Tank With Relief Valve

AS STEAM ENTERS the tank and mixes with the water it condenses (because of difference in temperature and pressure) and gives up heat to the water. Ultimate temperature of the water will be governed by (1) amount of heated water drawn off (2) size of steam line or (3) amount of steam entering the tank and the temperature of incoming water.

As the system is functioning satisfactorily I do not think *PAH* will run into trouble, assuming the steam line is fitted with a reducing valve and the tank is heavy enough to withstand maximum pressure. However he should install a relief valve on the tank and set it a trifle below the steam pressure.

Bogota, N. J. FRED MEYER

Fabricate a Set of Coils

BEST SOLUTION TO PAH's problem is to remove the heating coils and install small-sized steam pipe instead. It is also a good idea to install a thermostatically operated steam-control valve. Set the pressure-reducing valve for a maximum pressure of 10 psi and check the entire system to make sure all valves, gages and traps are operating properly.

As now arranged, the water being under a lower pressure cannot flow into the coils. And instead of hot water the faucets will discharge steam. Also, increasing the tank pressure fom 15 to 40 psi may prove disastrous unless the vessel is able to withstand such pressure and is equipped with a properly adjusted relief valve.

Philadelphia, Pa. T F CUNNINGHAM

Boiling Temperature Depends on Pressure

RAISING STEAM PRESSURE to 40 psi and cutting water pressure to 15 psi may scald a person when he opens the water faucet. If the hot-water tank is strong enough to hold the steam pressure there is no danger of explosion.

If there is a check valve on the water supply and no relief valve on the tank, pressure in the tank will rise to that of the steam as soon as inflow of heat from the steam catches up

(*Continued on page* 142)

CENTRIFUGAL PUMP Q AND A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

8—Heads and Head Measurements: Part I

Eighth in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—What is meant by head, as applied to centrifugal pumps?

A—Fundamentally, head refers to static difference in level between a liquid's free surface at rest and an arbitrarily selected elevation; for example, difference in elevation between the liquid's surface in the suction well and that in a pump's discharge tank, Fig. 1. This difference may be expressed in pressure (psi) or in feet static head; therefore it refers to a difference in pressures or levels. In referring to a centrifugal pump, head becomes a measure of energy delivered (work done) by the pump at a given speed and capacity, and includes static head, velocity head and frictional losses in piping and fittings.

Q 2—What are the parts of a pumping-system head?

A—Total head against which a pump operates includes: (1) static head (2) difference in pressures existing on the liquid, if any (3) friction head (4) velocity head and (5) entrance and exit losses.

Q 3—What is static head?

A—It is a difference in elevation. Thus, a pumping system's total static head is the difference in elevation between the liquid levels of the suction and discharge, Fig. 1 and 2.

Q 4—What is static discharge head?

A—It is the difference in elevation between the pump's center line and the discharge liquid's level, Fig. 1 to 3.

Q 5—What is static suction lift?

A—If the suction liquid level is below the pump's center line, Fig. 1, it is generally called a static suction lift. This is the difference in elevation between the pump's center line and the liquid's level in the suction well.

Q 6—What is static suction head?

A—When the suction-liquid level is above the pump's center line, Fig. 2, it is generally called a static suction head, and is the difference in elevation between the suction liquid level and the pump's center line. When the suction supply is taken from a closed vessel with liquid level above the pump's center line, as from a condenser's hot-

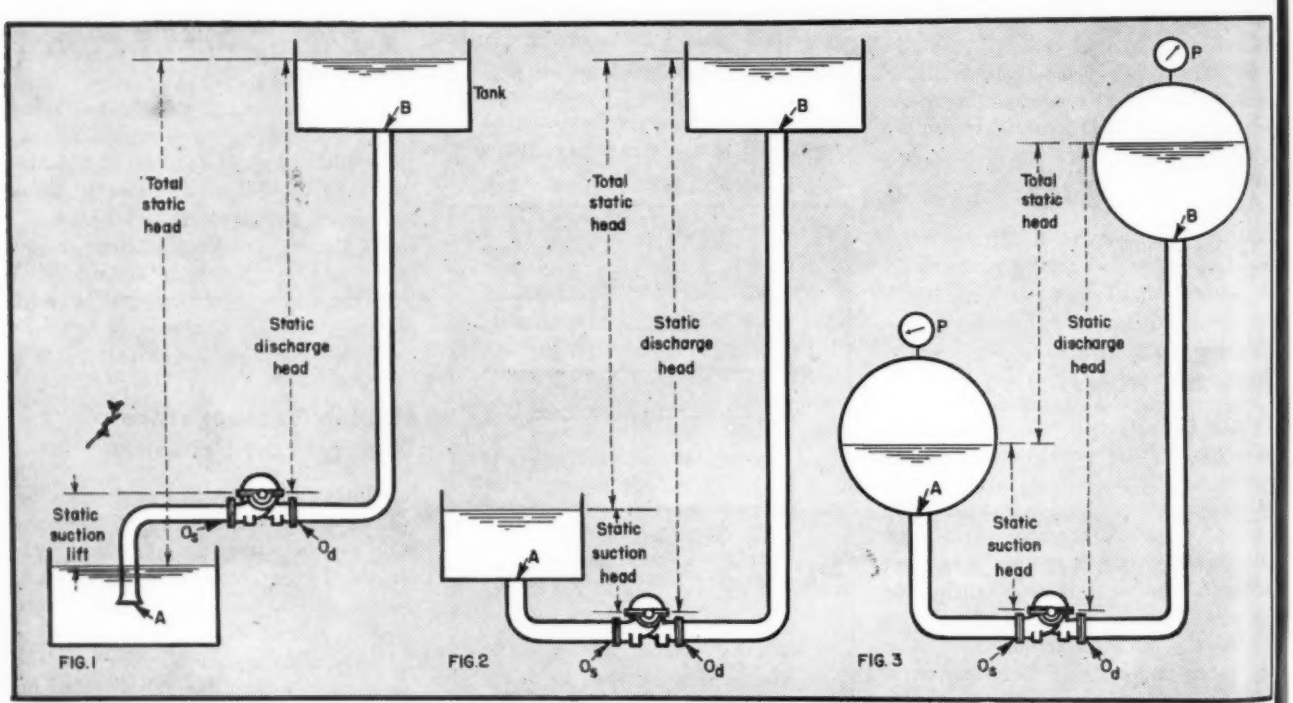


Fig. 1—Static suction lift, static discharge and total static heads when a pump operates with static suction lift. Fig. 2—Static suction, static discharge and total static heads when static suction head exists. Fig. 3—Same as Fig. 2 but for conditions where pressure other than atmospheric may exist on the suction and discharge liquid's surface

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well, difference in suction-liquid-level elevation and the pump's center line is commonly called static submergence.

Q 7—When either suction or discharge liquid's level is under pressure other than atmospheric, Fig. 3, is this pressure a part of static head?

A—Opinion varies on considering this pressure part of static head, or separately. The latter generally gives a clearer picture of the pumping system and the head components.

Q 8—What is meant by friction head?

A.—It is the equivalent head expressed in feet of liquid pumped, necessary to overcome friction losses caused by liquid flow through the piping, including all fittings. Friction head varies with quanity of flow, size, type and condition of piping and fittings and characteristics of liquid pumped.

Q 9—What is velocity head?

A—Velocity head is related to velocity of a liquid at any given point in its flow line, expressed in feet head of the liquid. If liquid is moving at a given speed, velocity head is equivalent to distance liquid would have to fall in a vacuum to attain that velocity.

Velocity head in feet of liquid pumped = *(liquid's velocity in feet per second)*^{2} ÷ 64.4. If velocity in a pipeline is 5 ft. per sec, its *velocity head* = $5 \times 5 \div 64.4 = 0.39$ ft.

Q 10—What are entrance and exit losses?

A—Except where a pump's suction supply is from a main under pressure, such as a city water system, it generally comes from a tank or reservoir. Suction pipe's connection to the tank wall or its end projecting into the liquid is the suction pipe's entrance. Frictional losses at this point are called entrance losses. Their magnitude depends on entrance design, a well-designed bell mouth having lowest loss. Likewise, where the discharge line terminates, its end is called the exit. Generally this exit is the same size as the piping, and the velocity head of the liquid is lost. Sometimes the discharge-pipe end has a long taper so the velocity is reduced and its energy recovered.

Some engineers consider entrance and exit losses part of the suction and discharge pipes' friction losses. Others consider them separately to make sure they are not overlooked. The latter has the advantage also, that it is easy to see if either or both losses are excessive.

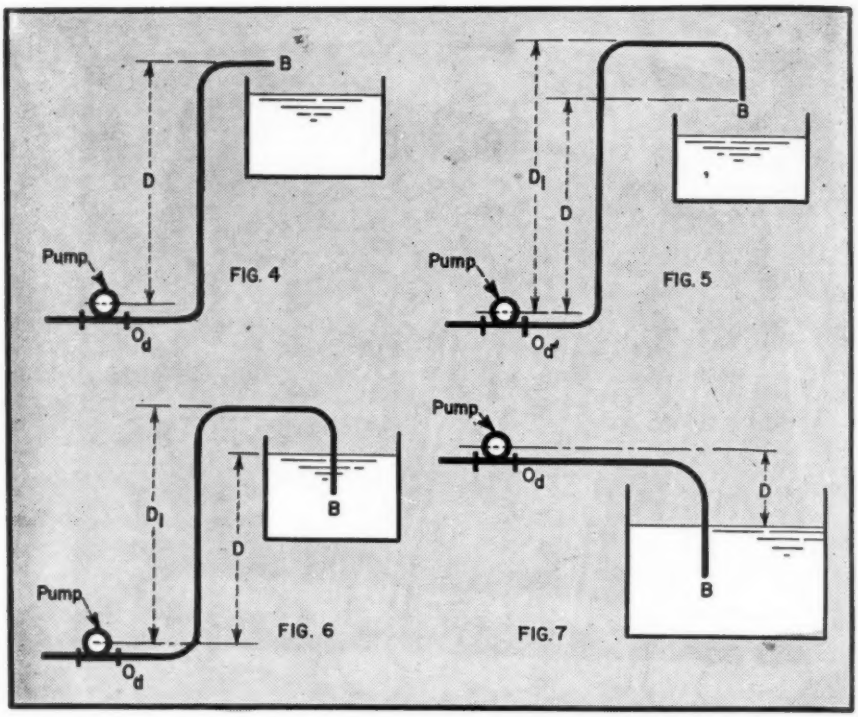

Fig. 4—D represents static discharge head when pump discharges over side of elevated tank. Fig. 5—D equals static discharge head when pump is in operation and discharging through loop over side of elevated tank. Fig. 6—D equals static discharge head when pump is in operation and discharging through sealed loop over side of elevated tank. Fig. 7—D equals negative static discharge head when pump discharges into body of liquid below pump's center line

Q 11—What is suction head?

A—It is the head existing at the pump's suction nozzle and can be expressed in absolute or gage pressure, or feet head.

Q 12—What is suction lift?

A—Suction lift exists when the total suction head is below atmospheric pressure.

Q 13—How is the suction head or suction lift determined?

A—Total suction head, as now generally applied to centrifugal pumps, is the static suction head measured to the pump's center line, minus friction losses for the capacity pumped, minus entrance losses at beginning of suction line, plus any pressure existing on the suction supply. A pressure gage connected to the pump's suction indicates total suction head minus velocity head at the point where the gage is connected. Because a suction lift is a negative suction head, a vacuum gage indicates total suction lift, plus velocity head at the point where the gage is connected to the suction line.

Fig. 1 to 3 show the three commonest suction conditions. In Fig. 1, suction lift equals static suction lift measured to the pump's center line, plus total friction loss in the suction line and entrance losses at *A*. In Fig. 2, the suction head equals the static suction head, measured to pump's center line, minus entrance losses at *A* and friction losses in suction line to the pump suction flange. Suction head under conditions of Fig. 3 equals total static head measured to the center line of the pump, minus entrance losses at *A* and friction losses from *A* to the pump's suction flange, plus pressure indicated by gage *P*.

Q 14—Does a vacuum gage connected into the suction line at O_s, Fig. 1, indicate the true suction lift?

A—No, it indicates suction lift, plus velocity head or static suction lift, as measured to pump's center line, plus entrance losses at *A*, plus total friction losses in the suction line, plus velocity head. In other words, the vacuum gage reads too high by an amount equal to the velocity head.

Q 15—Does a pressure gage connected into the suction line at O_s, Fig. 2 and 3, indicate the true suction head?

A—No, it indicates suction head minus velocity head. In Fig. 2 the gage reads the static suction head, measured to the pump's center line, minus entrance losses at *A* and total friction losses in the suction line, minus the velocity head. For conditions in Fig. 3, the gage also reads the suction head.

(*Continued on page* 138)

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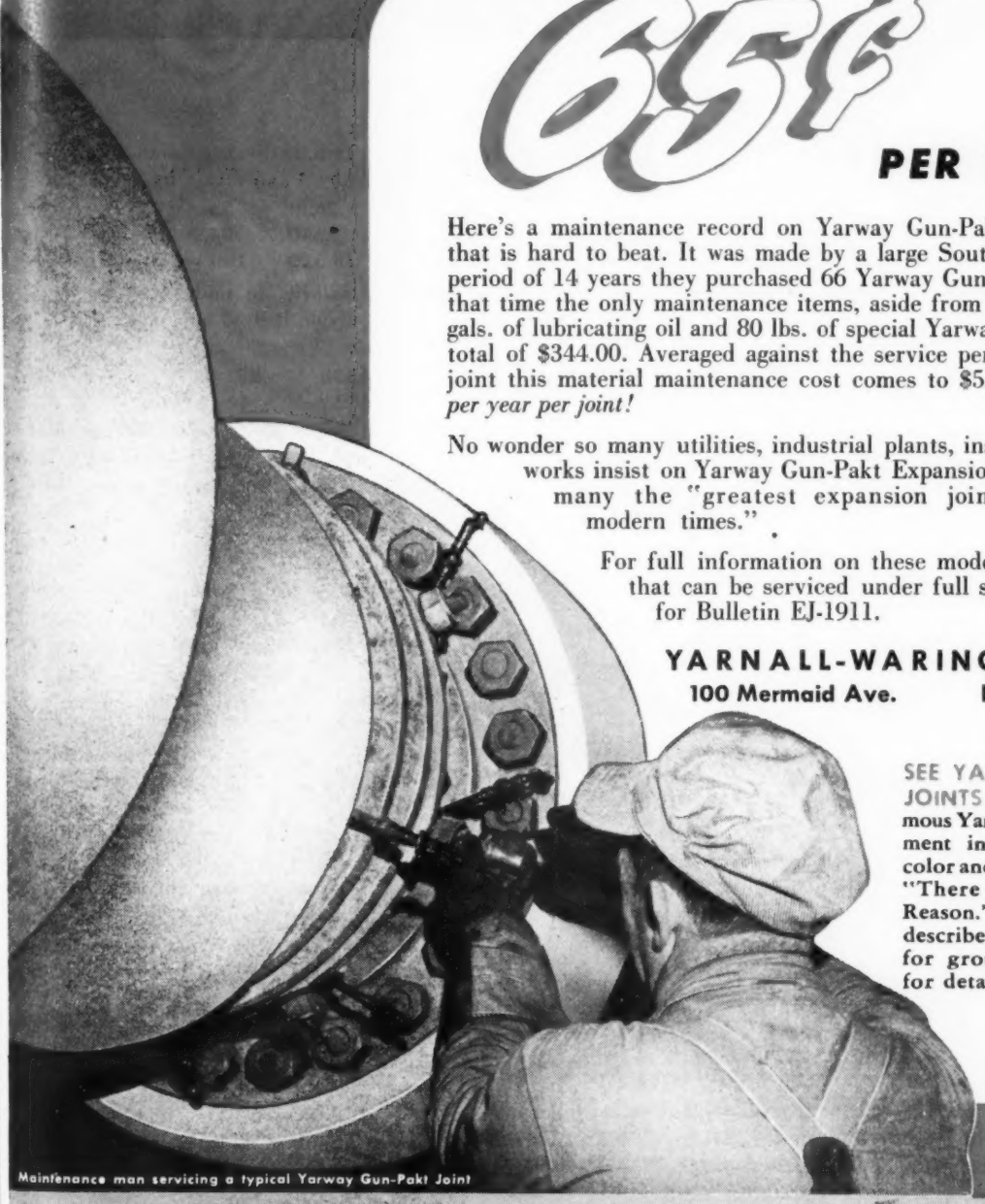

Maintenance man servicing a typical Yarway Gun-Pakt Joint

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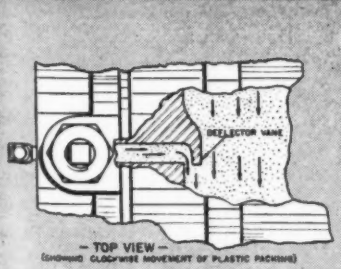
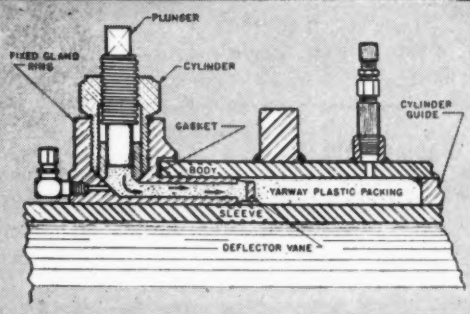
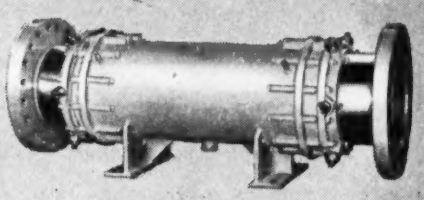


— TOP VIEW —
(SHOWING CLOCKWISE MOVEMENT OF PLASTIC PACKING)





Double end flanged-type Yarway All-Steel Gun-Pakt Joint, 300 lbs. pressure.

YARWAY GUN-PAKT EXPANSION JOINT

MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

5—Hints for Multiplication and Division

▶ WE HAVE SEEN THAT when two or more numbers are multiplied a given percentage error in one produces the same percentage error in the product. This holds for division, also. A certain percentage error in either divisor or dividend creates the same percentage error in the quotient. The number with the largest percentage error dominates the situation, making it useless to have much greater accuracy in the other figure.

Let's apply this idea to a sheet of metal: The sheet is 8⅜ in. wide and 0.028 in. thick (to the nearest thousandth). What length contains 10 cu in. of metal? Note that the thickness is dependable to only two significant figures, so carry all factors and results to 3 SF, only. To 3 SF 8.38x0.028 = 0.235 and 10 ÷ 0.235 = 42.5 in. While this is written to 3 SF for "good luck," it is not dependable beyond 2 SF (simply 42 or 43 in.).

In engineering it is often necessary to carry out a string of multiplications or divisions, or a combination of both. While such operations are generally best handled by computing machines, slide rules or logarithms, these conveniences may not be at hand when the computations must be made. Longhand computers, working such problems, can waste a lot of time fussing with decimal points and excessive significant figures. An example shows how to avoid such waste:

What is the value of 3.1416x8⅜x 8⅜ x 42.1 ÷ 42.3 ÷ 4658, if the 8⅜ is not dependable beyond ½ in.? In that case, the product may easily be in error by at least 1%, so that anything beyond 4 SF is a waste of time. Therefore, carry all numbers and operations (up to the last) to 4 SF only.

The problem then reads:

What equals 3.142x8.375x8.375x42.1 ÷ 42.3 ÷ 4658?

Discarding decimal places, this becomes:

3142x8375x8375x421 ÷ 423 ÷ 4658 = ?

Continuing to neglect decimal points, and sticking to 4 SF, we get:

3142 × 8375 = 2631
2631 × 8375 = 2203
2203 × 421 = 9275
9275 ÷ 423 = 2193
2193 ÷ 4658 = 4708

To locate the decimal point by inspection, set down the original problem in roughly approximate form, but with correct decimal places, thus:

$$\frac{3\times8\times8\times40}{40\times4000}=\frac{3\times8}{500}=\frac{24}{500}=0.05\text{(about)}$$

Therefore the answer, to 3 SF, is 0.0471

Convenient Reciprocals

Everybody knows the following short way to divide a number by 5: Just multiply by 2 and divide by 10:

1452 ÷ 5 = ?
1452 × 2 = 2904
2904 ÷ 10 = 290.4, ***answer***

Again, to divide a number by 25, multiply by 4 and divide by 100, thus:

2630 ÷ 25 = ?
2630 × 4 = 10,520
10,520 ÷ 100 = 105.2, ***answer***

Similarly, to multiply a number by 25, divide it by 4 and multiply by 100. thus:

4328 × 25 = ?
4328 ÷ 4 = 1082
1082 × 100 = 108,200, ***answer***

In the same way, 3 1/3 or 33 1/3 can be paired with 3, 16 2/3 with 6, and 125 or 12½% with 8.

Note that the two numbers of each such pair multiplied together give some power of 10, such as 1 or 10 or 100 or 1000, etc. Note, also, that one number of the pair is a "hard" number to handle in multiplication or division and the other a relatively "easy" number.

This is more clearly shown in the table below. Any number on the "easy" side, multiplied by any corresponding number on the "hard" side gives some power of 10. With suitable adjustment of decimal points, opposite numbers are reciprocals. We then get these timesaving rules:

Rule 1:

To *multiply* by any listed "hard" number, *divide* by any corresponding "easy" number, and then adjust the decimal point by inspection.

Rule 2:

To *divide* by any listed "hard" number, *multiply* by any corresponding "easy" number, and then adjust the decimal point by inspection.

Note that here, as in other problems involving multiplication and division, it is often convenient to omit all decimal points until the final answer is reached. At that stage the decimal point is easily located by inspection and common sense.

Problem: **What is 16⅔ % of $2.40?**
Solution: **240 ÷ 6 = 40. Answer is $0.40.**

Problem: **Divide 614 by 1¼.**
Solution: **614 × 8 = 4912. By inspection, 491.2 is the answer.**

Paired Numbers—Reciprocals

Decimal points are disregarded, as explained in text

"Hard" numbers					*Corresponding "easy" reciprocals*				
1/2	0.5	5	etc		0.2	2	20	200	etc
1/3	3 1/3	33 1/3	etc		0.3	3	30	300	etc
1/4	0.25	2.5	25	250 etc	0.4	4	40	400	etc
1/6	1 2/3	16 2/3	166 2/3	etc	0.6	6	60	600	etc
1/8	1.25	12.5	125	etc	0.8	8	80	800	etc
1/12	0.83 1/3	8 1/3	etc		0.12	1.2	12	120	etc

SOLNUS OILS...

end carbon trouble, cut diesel shutdowns in half

An ice and cold storage plant in central Pennsylvania was all heated up about diesel oils. They had two diesels, both direct-connected to ammonia-compressors, and both driving generators by belt drive.

Heavy carbon deposits were sticking the rings and blocking exhaust ports and pipes. Twice a year the diesels had to shut down to have carbon scraped.

Three and a half years ago, a Sun Diesel engineer recommended the proper grade of Sun's Solnus oil for these engines. Since then rings, ports and pipes have been clean. Engines are shut down only once a year, and oil remains clear.

This is just one of the many current cases on file at Sun, which illustrate how the combination of Sun's engineering experience, plus Sun's proved line of diesel lubricants have saved money and eliminated headaches for operators.

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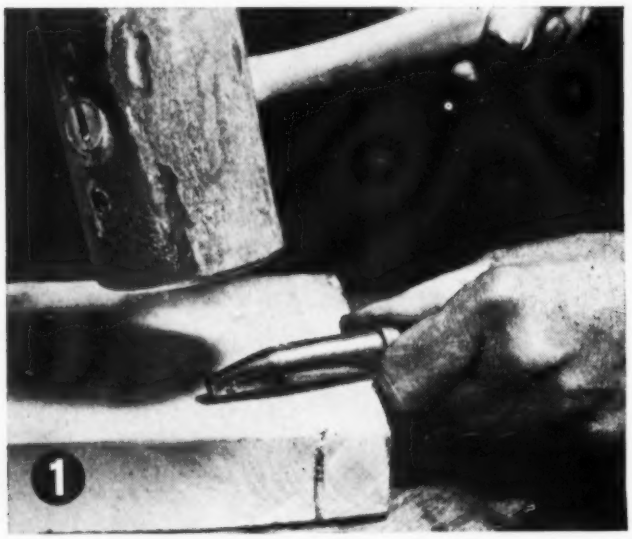
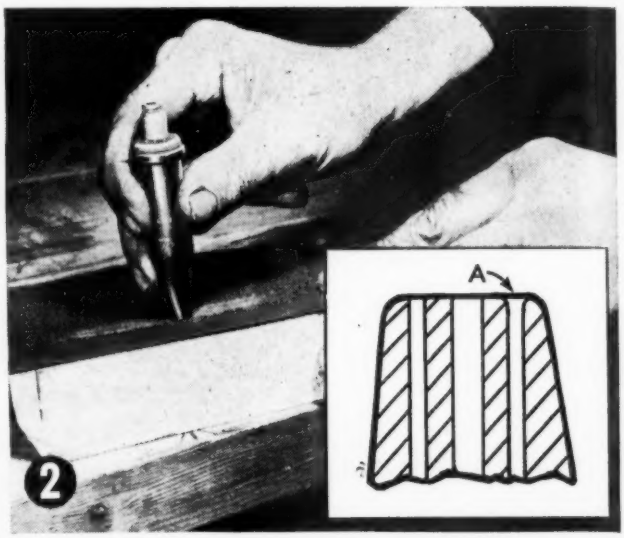
HOW TO REPAIR NOZZLES OF GAS TORCHES

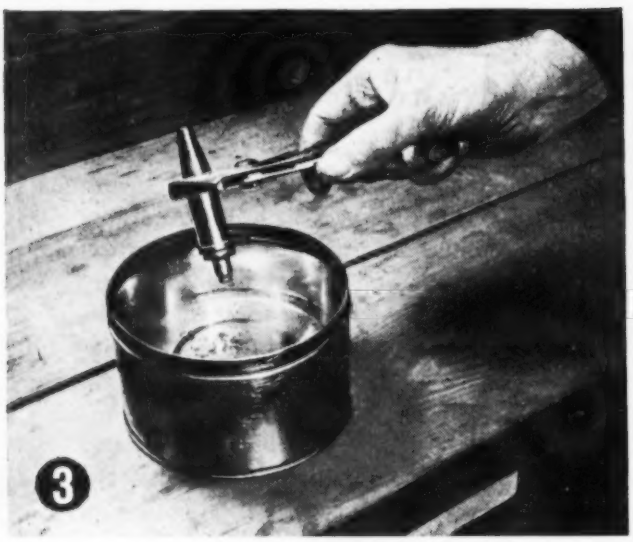
No OPERATOR can do good work with a cutting or welding torch unless it is in good condition. This is particularly true of a nozzle because a non-uniform flame is harder to use and does a poor job. The commonest cause of backfire or flashback is a dirty cutting nozzle or obstructed welding head.

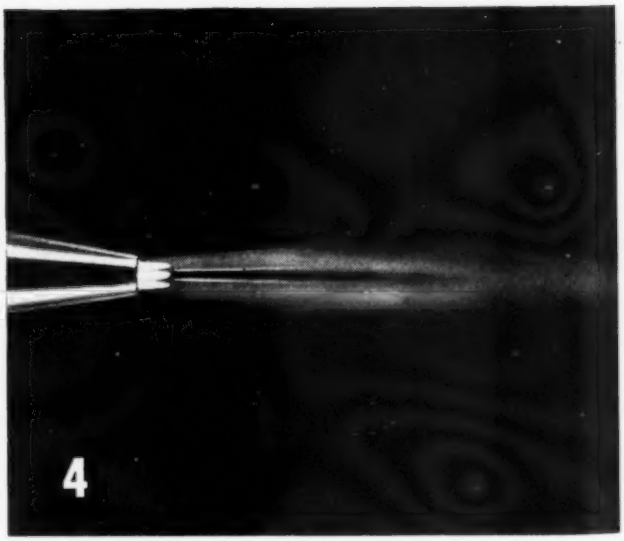
Flying particles of slag, carbon or molten metal often lodge in nozzle openings. Usually it is only necessary to clean the passages with a drill to restore the correct flame shape. (Correct drill size is usually furnished with instructions that go with a torch.)

These easy instructions show how to check the nozzles and put damaged ones back in serviceable condition. Good practice dictates following this procedure before starting a new job. *Courtesy, The Linde Air Products Co.*









1 Bent nozzles can usually be straightened with an 8-oz rawhide mallet. Place the nozzle on a wood block and pound with light blows. Stop frequently and check for straightness.

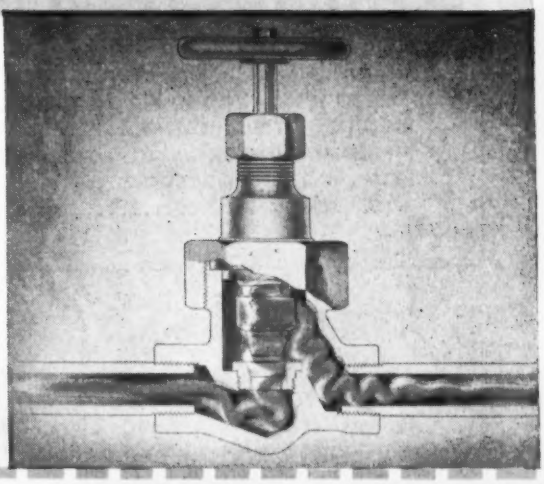
2 Flame end of nozzle must be square and free of scratches. Gas passages should be clean and free of flared openings, *A*. Remove bellmouth by holding nozzle perpendicular and rubbing the end on fine emery cloth. Use long straight strokes.

3 Nozzle seat must be smooth and its contour uniform. To soften the seat and loosen tightly adhering dirt, heat the end below clamping-nut ring in a gas flame to a dull red and quench in water. Clean gas passages with correct size drill (see "How to —" article, p 126, Jan, 1945, POWER). A special seat-reconditioning block will remove scratches and nicks from seat.

4 After the nozzle has been cleaned and repaired, insert it in a torch and light the flame. Preheat flames should be uniform in size and shape and oxygen stream symmetrical.

HOW EDWARD VALVES CUT PRESSURE LOSS, PREVENT UNDUE TURBULENCE and SAVE MONEY

PROBLEM: In an ordinary globe valve, sharp turns often cause excessive turbulence and increase pressure drop. Valve wear is accelerated, power is wasted and efficiency lowered. Years ago, Edward began research on the problem of reducing pressure drop through small forged steel valves.

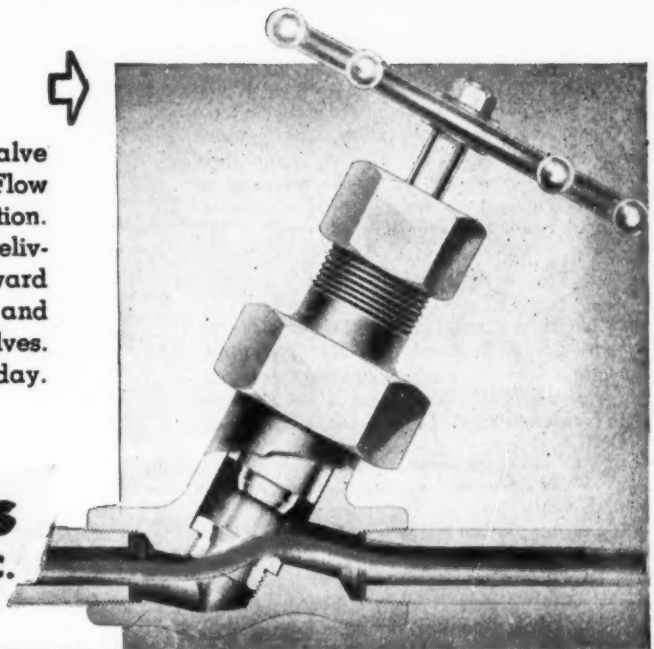


Here's what happens to flow in an ordinary globe valve. Sudden changes in direction mean excessive turbulence and increased pressure drop. Flow like this is a fuel thief—a money waster!

SOLUTION: Long ago, Edward designed the 60° stem globe valve as the first big step. For the past several years, Edward engineers have conducted a continuing and integrated program on flow characteristics and pressure drop. Actual flow tests on Edward and other valves guided the new design improvements now standard in Edward inclined-stem forged steel globe valve construction.

Special test hook-up for measuring pressure drop and determining flow principles through valves. Orifice type flow meters, mercury manometers and gages are used to check actual pressure loss.

RESULT: This is the flow pattern through today's streamlined Edward inclined-stem valves with globe valve tightness and gate flow. Flow is eased through with no sharp changes of direction. With these Edward valves, maximum volume is delivered at the equipment where it's needed. Edward BETTER VALVES Catalog No. 103 gives dimensions and design data on these and other Edward steel valves. If there isn't a copy in your file, write for one today.



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FOR THE ENGINEER'S BOOKSHELF

TRAINING FOR SUPERVISION IN INDUSTRY ..... By George H Fern
THE BOGEY OF ECONOMIC MATURITY ..... By George Terborgh
DIESEL-ELECTRIC PLANTS ..... By Edgar J Kates
PIPING HANDBOOK ..... By Sabin Crocker
HOME WIRING HANDBOOK ..... Pub by Westinghouse Elec Corp
BOOKLETS ..... Brief Reviews

Industrial Supervision

TRAINING FOR SUPERVISION IN INDUSTRY (1945) *By George H Fern, director, Michigan State Board of Control for Vocational Education. Pub by McGraw-Hill Book Co, 330 West 42nd St, New York 18, N. Y. 188 pp, 6x9, illustrated, cloth* $2.

Although not always conscious of it, the average power engineer is a supervisor and to a considerable extent his success depends on ability to handle the men under his control. One of the most important phases of this supervisory responsibility is that of instructing, but before he can instruct, he must be given his own instructions and must know how he and his men fit into the picture. He must participate in the top-management conferences that affect him and his department. He must know how to give instruction, and he may have to know how to train others to train men.

This book deals specifically and practically with the supervisor's training problem. It is intended to give the supervisor direct help on the problems of his daily job, especially in the fields of human relations and training. The author has drawn heavily on the expressions of supervisors who have participated in training conferences under his direction. Throughout the book, the conference method of breaking down job problems and analyzing them through group discussions is presented as a sound and certain means of arriving at understandings and solutions.

Economic Future

THE BOGEY OF ECONOMIC MATURITY (1945) *By George Terborgh, director of research, Machinery and Allied Products Institute. Pub by the Machinery and Allied Products Institute, 221 N La Salle St, Chicago, Ill. 262 pp, 6x9, illustrated, cloth.* $3.

With reconversion in full swing, all thoughts turn to the nation's economic future. Do we face business depression, stagnation of industrial activity at low levels, or a rising curve of activity and industrial progress? Many doubts have been expressed about the business future, most of them based on the theory that this country has reached economic maturity and that we should expect no further industrial growth. This theory rests on the four assumptions that: (1) population growth will decline (2) the frontier has passed (3) there will be no great new industries and (4) depreciation reserves have ever greater importance.

The author examines each of these assumptions in turn, and by historical and statistical evidence shows what he considers their essential weaknesses. He concludes that the real problem is not one of combating chronic economic stagnation but rather one of damping the cyclical swings that have always characterized our economy.

The book is not written for the professional economist but is addressed to the intelligent layman. Power men interested in knowing more about the economic problems of the postwar era will find this study worth while.

Diesel-Electric Plants

DIESEL-ELECTRIC PLANTS (*second edition*, 1945) *By Edgar J Kates, consulting engineer. Pub by American Technical Society, Chicago, Ill. 272 pp, 5½x8¼, illustrated, cloth.* $2.50.

Many books have been written on diesel engines and even more on electrical equipment. Realizing the need for coordinated treatment of diesel-plant electrical equipment, which is greatly influenced by the characteristics of the prime mover, the first edition set out to deal with the construction, operation and maintenance of the electrical devices used in this specialized application. After an introduction dealing with the major characteristics of diesel prime movers, discussed, in turn, were types of generators, voltage regulators, parallel operation, governing, automatic plants, electrical operation, controls and alarms for diesel engines, electrical equipment of diesel locomotives, and installation and maintenance. Treatment was clear cut and practical, making the book particularly useful to operating engineers.

The second edition follows the same straightforward and useful pattern, but contains much additional information covering developments in the nine years since the first edition. The chapters on voltage regulation now include the new quick-acting rheostatic-type regulators, the electronic units and also the simple vibrating types now widely used. Information on modern methods of automatic synchronizing has been added. The chapter on engine governors has been largely rewritten to cover the many forms of hydraulic governors now in use, as well as the improved mechanical governors. Likewise the chapter on controls and alarms has been enlarged, including descriptions of many new devices and an informative series of typical hookups ranging from simplest to most elaborate. Additional material appears in discussions of electric starting, and electric transmissions for diesel locomotives.

Home Wiring

HOME WIRING HANDBOOK. *Published by Westinghouse Electric Corp, 306-4th Ave, Pittsburgh, Pa.* 121 *pp, numerous illustrations and tables, 5x7¼, Cloth,* $1.

A manual prepared for architects, builders, electrical contractors and wiremen. Included are equipment, circuits, outlets, circuit protection and grounding. A complete section is devoted to details of approved wiring devices. The handbook is not a treatise on wiring; it is rather a guide to planned wiring that is not only safe but that also has the ability to serve effectively and efficiently.

Piping

PIPING HANDBOOK (1945, *fourth edition*) *By Sabin Crocker, senior engineer, engineering division, The Detroit Edison Co. Pub by McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y. 1376 pp, 4¾x7, illustrations, charts and tables, cloth.* $7.

This handbook is for the engineer, designer and contractor concerned with piping installations for steam and power plants, heating and plumbing systems, and oil, gas and fluid-power transmission systems. Effort has been made to keep the book as self contained as possible, but where length of subject matter has made this impracticable, references have been cited.

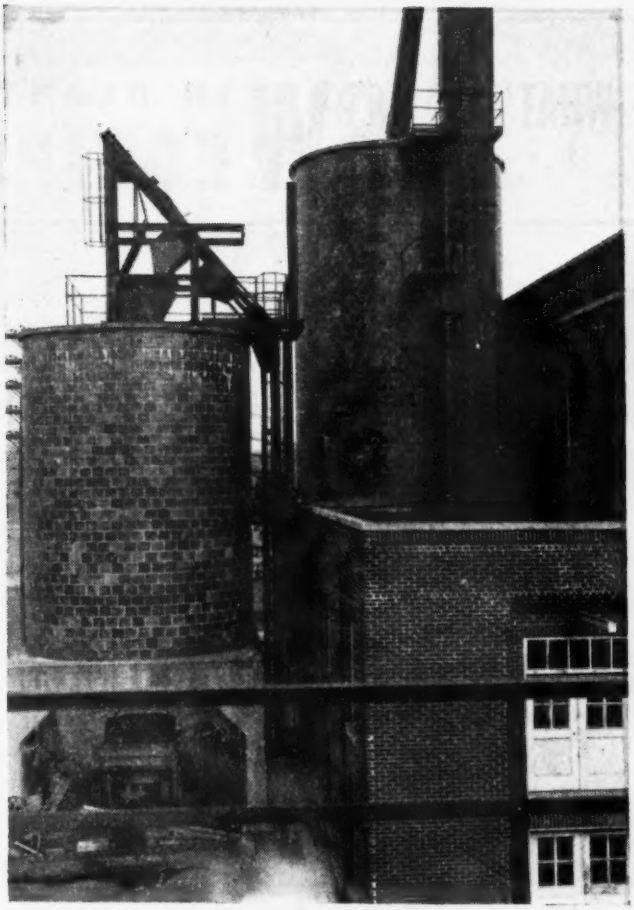
This fourth edition has been extended to include chapters on gas piping, refrigeration piping, hydraulic-power transmission piping, and corrosion. The chapter on water-supply piping has been considerably aug-

(*Continued on page* 150)

FAIRFIELD
Coal and Ash Handling SYSTEMS

Designed— Built— and Erected by

FAIRFIELD

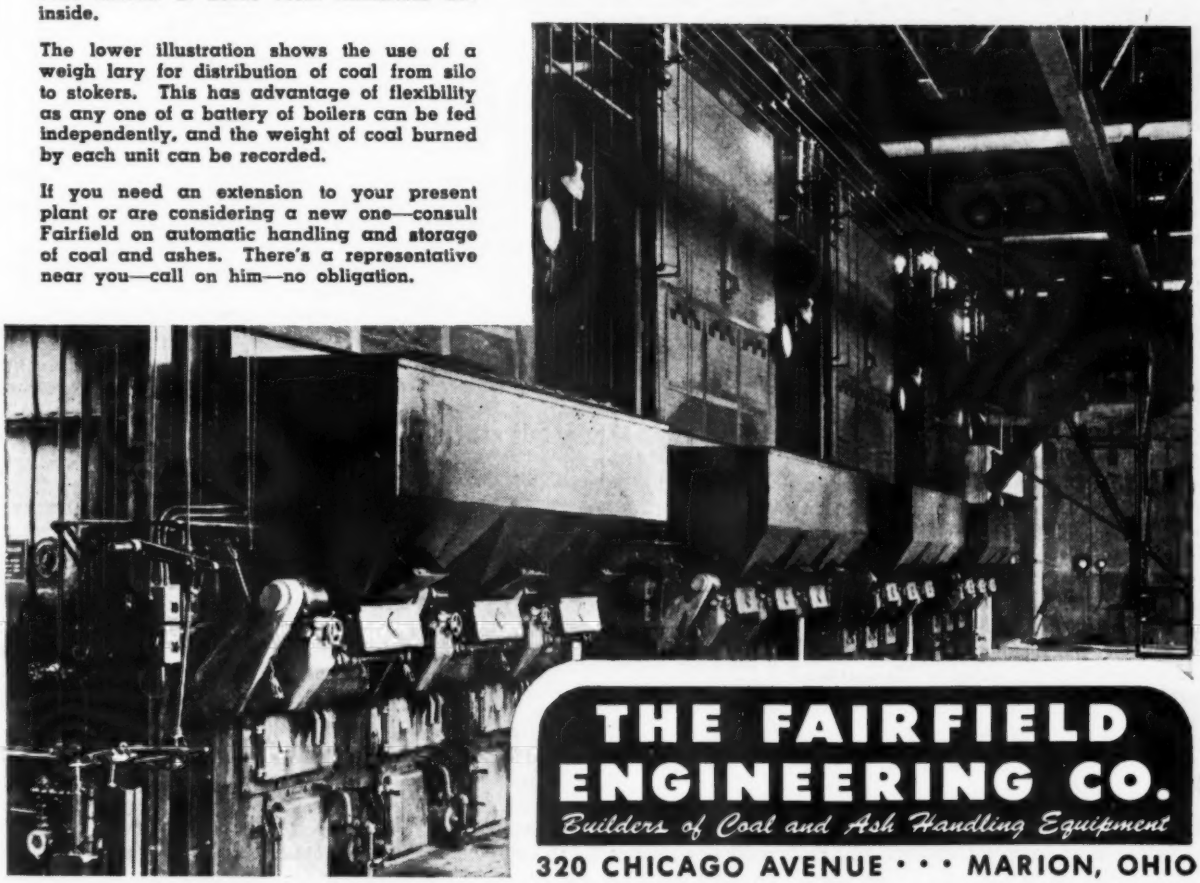


The coal and ash handling system illustrated is typical of the Fairfield method of designing and erecting a complete system to meet the needs of the individual plant. Note that the coal silo is an integral part of the power house and coal is fed to silo by means of an elevator.

The ash silo adjacent to the power house uses a skip hoist for handling ashes from boilers to silo. Both the coal and ash silos are made of vitrified tile which resists moisture—air channels in tile act as insulation against freezing in cold weather and locating silos outside of boiler room eliminates dirt inside.

The lower illustration shows the use of a weigh lary for distribution of coal from silo to stokers. This has advantage of flexibility as any one of a battery of boilers can be fed independently, and the weight of coal burned by each unit can be recorded.

If you need an extension to your present plant or are considering a new one—consult Fairfield on automatic handling and storage of coal and ashes. There's a representative near you—call on him—no obligation.



THE FAIRFIELD ENGINEERING CO.

Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE • • • MARION, OHIO

WHAT'S NEW IN PLANT EQUIPMENT

Hand Tachometer

NEW DIRECT-INDICATING hand tachometer has design and quality similar to manufacturer's prewar instrument. It has two scales and five different ranges: 45 to 180,

150 to 600, 450 to 1800, 1500 to 6000 and 4500 to 18,000 rpm. Change of range is by rotation of knurled barrel head. Instrument is supplied complete with carrying case and accessories, including a 6-in. circumference wheel for measuring surface speeds. **James G Biddle Co, 1211 Arch St, Philadelphia 7, Pa.**

Brake Block

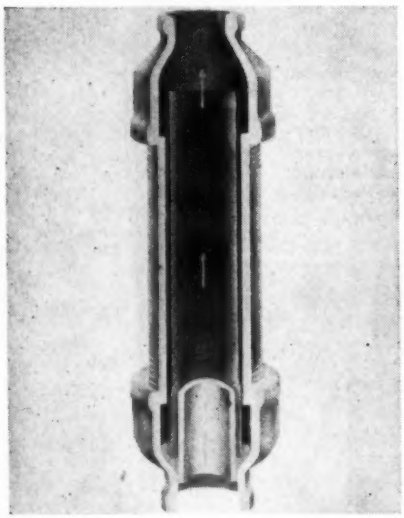
KEY-LOK BRAKE BLOCK possesses quick replacement features. Block consists of lateral "fishtail" metal strips or keepers in which bolts are inserted, spaced to fit in brake bands. These keepers slide into fishtail slots cut into the block. Therefore, bolts, bands or shoes do not have to be removed for relining; all that need be done is to loosen keeper nuts slightly, slide off the old and put on the new, tighten bolts and make normal adjustments. **Manhattan Rubber Mfg Div, Raybestos-Manhattan, Inc, Passaic, N. J.**

Cutting Electrode

AN IMPROVED CUTTING ELECTRODE permits increased speed in metal cutting. *Ellpro* electrode, of steel in form of a hollow tube, has an adhesive coating, which prevents it sticking to cutting surface. It is used with oxygen, which permits safety to the user at any depth under water. Speed of operation is a major advantage of new electrode; a molten arc is obtained the instant it is placed against surface to be cut. It can be utilized successfully under water or anywhere on land, with either ac or dc current. A torch holder, perfected for the *Ellpro* electrode, prevents it from burning down to a point where it cannot be removed with ease. As its cutting life ends, it can simply be drawn from the holder and a new one inserted with practically no loss in time. **Ellwood Products Corp, Ellwood City, Pa.**

Propeller Flowmeter

WIDELY USED for metering water at ordinary temperatures, Builders *Propeloflo* meter is now available for metering hot water up to 250 F. A special high-temperature grease lubricates efficiently. Venturi design and all other special features of this streamlined propeller meter are retained. The *Propeloflo* is useful as a simple totalizing meter. **Builders-Providence, Inc, Providence 1, R. I.**



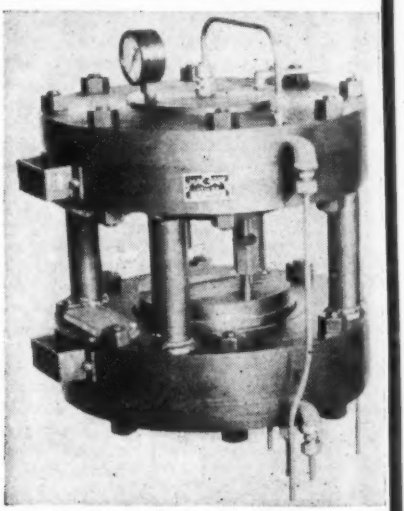
Check Valve

PERMATITE VALVE has no poppets, disks or other metal working parts. Back flow is checked by a Neoprene synthetic-rubber tubing, which offers positive control as tubing opens easily with either vacuum or pressure, permitting direct flow, and closes when flow is stopped. Valve installations and servicing are simplified. No manholes, sleeves or extractor equipment is required when valve is buried as tubing is permanently tight and its opening and closing movements are such as to prevent foreign matter fouling the valve or causing leakage.

Valve can be used successfully with air, natural gas, any commercial liquid including all petroleum products from crude oil to liquefied petroleum gases, hot or cold water, and any chemical that will not attack synthetic rubber. *Permatite* valve may serve as a foot, vertical, horizontal or angle valve in any suction or discharge line. Also, it may be employed as a mixing valve, pump-priming valve or as an air-compressor silencer. Immediate deliveries can be made on valves rated at working pressures up to 125 psi, in ½-, ¾- and 1-in. sizes. Other standard sizes are available. **Harman Equipment Co, 937 Santa Fe Ave, Los Angeles, Calif.**

Thrust Recorder

THRUSTORQ DETERMINES AND RECORDS thrust and torque of internal-combustion engines. Heart of instrument is a flexible diaphragm that forms one face of an airtight chamber. Poppet pilot valve admits compressed air to this chamber. The force to be measured is applied to outside diaphragm and is opposed by internal pressure. As force increases, pilot valve is opened and admits



more air to balance the increased force. As force decreases, air is exhausted until external force and internal pressure are equal. Thus air pressure within chamber provides a direct measure of externally applied force.

Thrustorq permits remote reading of any number of manometers, pressure gages or recording devices. Unit may be used to analyze many structural stress and strain problems. The *Thrustorq*, once installed, needs no attendant and, with a pressure recording device in the system, a continuous record can be had even at a remote distance. **Hagan Corp, Pittsburgh, Pa.**

Pressure Transmitter

TRIMOUNT PRESSURE TRANSMITTER records pressure on any continuous balance potentiometer. By a special switching arrangement more than one pressure can be recorded on the same instrument, which makes this transmitter particularly valuable

For SMOOTH Operation...

PIPELINES OF COPPER

Made in nominal sizes, Types K and L from ⅛" up to and including 12", Type O from 3" to 12" inclusive.

A big asset in any plant are lines that cannot rust

ANACONDA Copper Tubes provide years of economical operation. They resist corrosive action, retain a smooth, clean interior, with no built-up rust deposits to retard flow, overload pumps, or contaminate costly products. And in addition, the use of soldered connections reduces installation costs.

In planning future pipeline installations, prepare for the day when copper tubes will again be available. Write for Publication C-24, "Anaconda Copper Tubes for Industrial Applications." 4574

AMERICAN VIBRATION ELIMINATORS

American Vibration Eliminators exclude vibration and compensate for thermal expansion in pipe systems.

Pressure-tight, safe for conveying costly gases or liquids, such as refrigerants, American Vibration Eliminators are easily installed. For catalogue, write American Metal Hose Branch, Waterbury 88, Connecticut.

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THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

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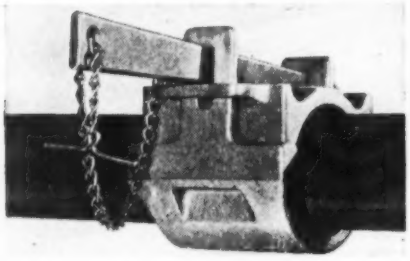
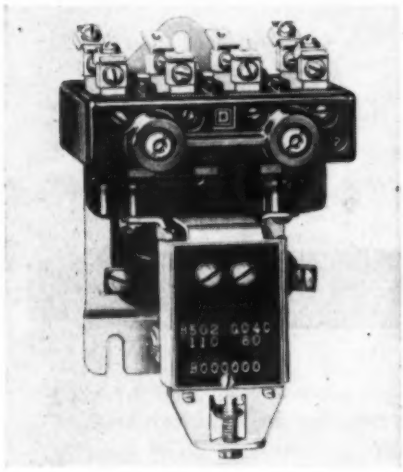
EQUIPMENT *Continued*

where a large number of pressures are to be recorded simultaneously. Installation of pressure transmitter is easy, involving simple wiring instead of elaborate piping. Available for any pipe fitting, this transmitter is usable for gas or liquids for pressures up to 1000 psi. No batteries are needed and the calibration is permanent. Transmitter has a wide temperature range and no amplification is required. **Trimount Instrument Co, 37 W Van Buren St, Chicago 5, Ill.**



Pipe Couplings

DRINKWATER PRESTO-LOCK COUPLINGS come in sizes from 1¼ to 16 in. and give 40-deg flexibility. These flexible couplings can be used with any plain-end pipe without threads, grooves or flanges. Only a hammer is needed to tighten wedge keys after the two sections are fitted over pipe ends and wedge keys have been inserted in key channels. **Drinkwater, Inc, 2323 S Michigan Ave, Chicago 16, Ill.**



Contactor

CONVERTIBLE CONTACTS, easily changed from normally open to normally closed without additional parts, are an outstanding feature of size 00 contactors. They are converted by removing a movable assembly, inverting it and putting it back in place. No additional parts are involved. All terminals, in addition to being accessible and conveniently located for individual or group mounting, have provision for two wiring clips. Contactor has newly designed contact bar and guide. Double-break silver contacts can be replaced readily, if and when prolonged, frequent operation makes replacement necessary. These Type Q contactors are available with two to six poles in any combination of normally open and normally closed contacts. Ratings are 600-v ac maximum; 10 amp open, 9 amp closed. **Square D Co, 4041 N Richards St, Milwaukee 12, Wis.**

Conveyor Lubricant

BOTLUBE LUBRICANT for high-speed chain conveyors is nonstaining, soapless, noncorrosive; it contains no oil. It has a tremendous wetting action; one drop will quickly cover a large area with a thin but durable film. *Botlube* is automatically dispensed through any simple container with a petcock and needle valve. **Turco Products, Inc, 6135 S Central Ave, Los Angeles 1, Calif.**

Valve Actuator

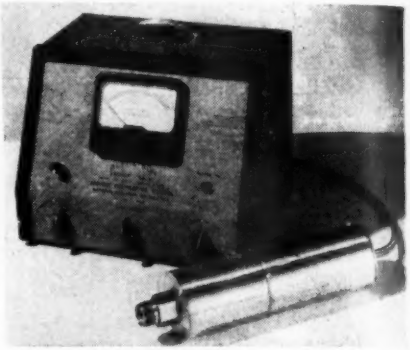
BENDIX HYDRODYNE ACTUATOR combines all advantages of direct hydraulic power. Unit incorporates a simple hydraulic system which produces force in a straight line through a hydraulic cylinder to open and close the valve. As valve seats the hydraulic pressure continues to build up, literally pressure-sealing the gate against leakage. Pressure is then hydraulically locked in the cylinder and only reverse action will unlock it. Should pressure drop from any cause it is automatically reestablished immediately. In addition, unit is provided with a completely independent hydraulic system, using a hand pump for emergency.

This pressure-sealing action eliminates any *bounce* or backlash in seating operation. Hydraulic operation eliminates *hammer-blow* action of other actuating devices and reduces maintenance of entire actuator to routine inspection, as hydraulic oil serves as a lubricant for all moving parts.

New actuators are available for valves from 4 to 36 in. and auxiliary regulating and indicating equipment can be provided for step-by-step position control, infinite position control or on-and-off control for any application. **Pacific Div, Bendix Aviation Corp, N Hollywood 36, Calif.**

Vacuum Gage

THE ALPHATRON is an all-metal ionization gage with continuous linear response to 10-mm total pressure. Ionizing agent is a stream of Alpha particles emitted by a radioactive source that permits operation at any pressure, including atmospheric, without damage to gage. Steady emission characteristic of the radioactive element and advanced amplifier design insure great stability and reduce needle flicker to a minimum. Present model covers from 0 to



10 mm in three ranges, all reading direct pressure. Ranges are 0 to .1 mm, 0 to 1 mm and 0 to 10 mm. Pressures may be read to 1% of full-scale reading in each case. Gage is ideal for measuring pressures of gases other than air, such as argon, water vapor and hydrogen, as linear response of gage holds true regardless of atmosphere. **Vacuum Engrg Div, National Research Corp, Boston 15, Mass.**

Dial Thermometer

EQUIPOISE THERMOMETER features a bimetallic helical-coil measuring element having case of alloy steel in most sizes, 18-8 stainless-steel connection nut and stem, and large, easily read numerals and temperature graduations on metal dial. Unbreakable glass crystal can be furnished.

Expansion of bimetallic coil rotates attached small shaft and indicating pointer as one unit over entire scale range and is the only moving part. There are no pivots, mechanical linkages or gears. Various standard ranges are available between limits of —90 F and 1000 F. Test or laboratory thermometers are graduated in both C and F on same scale. Thermometer is

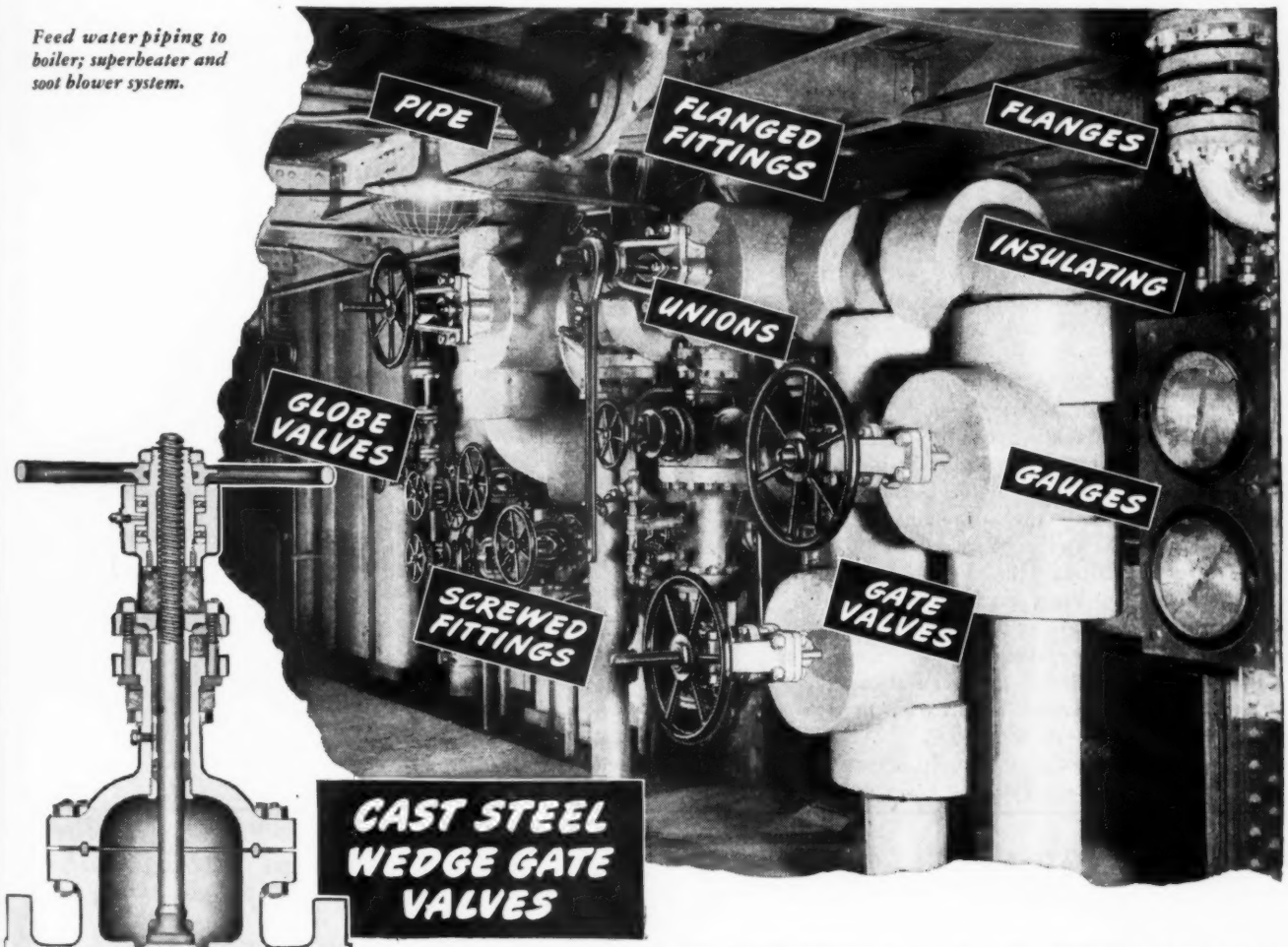
(*Continued on page* 154)

How CRANE Helps Solve Your Piping Equipment Problems

ONE SOURCE OF SUPPLY • ONE RESPONSIBILITY • ONE STANDARD OF QUALITY

If all piping systems worked under the same conditions, the above statement wouldn't mean much. The fact is that you alone can determine the exact requirements governing your choice of piping materials. Here is the vital distinction of the Crane line as a truly helpful service. First, Crane helps by giving you the world's most complete selection of piping equipment for all applications. Then, by making clear the relevant advantages of each type, Crane, with 90 years' experience, helps you choose with complete confidence. Ordering is simplified—your local Crane Branch or Wholesaler supplies all your needs. Uniform quality in all materials—backed by single responsibility—insures the best installation and peak performance. Stop and think how this service fits your reconversion plans.

Feed water piping to boiler; superheater and soot blower system.



SERVICE RECOMMENDATIONS: **Crane Cast Steel Wedge Gate Valves** are made for steam, water, oil, gas or air pressures up to 2500 pounds at 1000° F. The 600-pound class, shown in cross-section, with Carbon-Molybdenum body and Exelloy to No. 49 Nickel Alloy seating, are recommended for steam, water, gas or air up to 850° F. maximum; with Exelloy to Exelloy seating, for oil or oil vapor up to 1100° F. maximum; with Stellite to Stellite seating, for steam up to 1000° F. maximum. Available with screwed, flanged or welding ends in all sizes. See your Crane Catalog for specifications.

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POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION • FUEL CONSERVATION

1,250,000-Kva Short-Circuit Capacity Backs Up Circuit Breaker Tests

▶ AT THEIR TEST STATION, located adjacent to and fed by one of the largest concentrations of electric power in the country, Dr A C Bates and Prof A R Miller, of the Roller-Smith Div, recently demonstrated the operation of their 7.5- and 15-kv 600-amp oil circuit breakers when tested according to specifications of the joint industry committee.

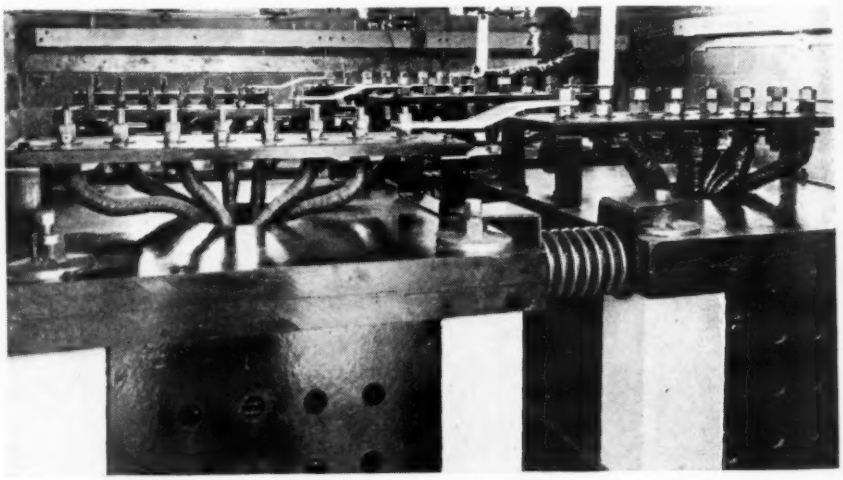
During intermission between tests Prof Miller explained working parts of the circuit breaker and showed oscillograms of voltage, current, contact movement and tank pressure taken during tests.

Tests to determine the interrupting capacity of circuit breakers should duplicate actual operating conditions as closely as possible. Thus Roller-Smith, through cooperation of the local utility, was able to obtain the advantages of both laboratory and field setups.

Test-station design limits short circuits to 250,000 kva (maximum capacity of the company's line of circuit breakers) and metal-clad switchgear backup breakers inside the test station operate before serious disturbance to the utility system can occur.

Test station described consists of a 66-v transmission line, disconnecting switches, special transformers, backup breakers, reactors and oscillograph recording equipment. The three single-phase transformers have five 10%-voltage taps on primary side. Secondary consists of four 2250-v windings that can be connected either in series or parallel. In addition to this, the transformers can be connected delta or wye.

Reactance consists of two reactors per phase with taps that provide 14 steps of impedance for 3-phase tests of 25,000 to 250,000 kva on the secondary winding. To provide an adequate margin of safety the backup breaker consists of one 3-pole 1200-amp 250,000-kva breaker for each phase. This combination has a 3-phase interrupting capacity of about 500,000 kva and a theoretical one-second rating of 180,000 amp. Backup breakers trip in a short, definite time after the fault is applied (test breaker closed in on short circuit) fault current itself initiating the timer.



Current-limiting reactors (two per phase) provide 14 steps of impedance. Special construction resists stresses and surges set up when test breaker opens

Joseph C McCabe Joins Power Staff

Through an unfortunate error in the printing plant, the biographical sketch of Joseph C McCabe, which started on page 134, Sept, POWER, was not continued on page 194 as indicated. We are reprinting below the entire biographical sketch:

Starting on POWER as assistant editor, Joseph C McCabe of New Jersey brings a good background of education and experience, plus some journalism. He was graduated (1936) in electrical engineering from Lehigh University where he gave special attention to English, history and business studies.

His practical background includes distribution-network estimating, power sales, power-plant engineering. He had practical experience in all power-plant duties, served as oiler, coal passer, pump man, turbine tender and fireman, handled meter maintenance and station feedwater treatment.

His experience included a 1400-psi pulverized-fuel station, a 400-psi stoker-fired station and a small chain-grate station.

As technical engineer he supervised meter rehabilitation and maintenance, feedwater treatment, operating procedure in boiler and turbine rooms. McCabe holds a Class A Gold Seal Operating Engineer's License, State of New Jersey. His primary responsibility will be industrial power plants.

Office of War Utilities Reviews Power Policy

"Late in the defense program, the Power Branch adopted a policy of authorizing installation of just enough generating capacity to get by and that's about what we did," an Office of War Utilities spokesman asserted recently as he reviewed the agency's war power policy and the broad conclusions that may be drawn as a result of its four years of operation.

• The principal technological developments of the electric power art which were thrust into prominence and used to great benefit during the war were the interconnection and coordination of neighboring power systems, the use of

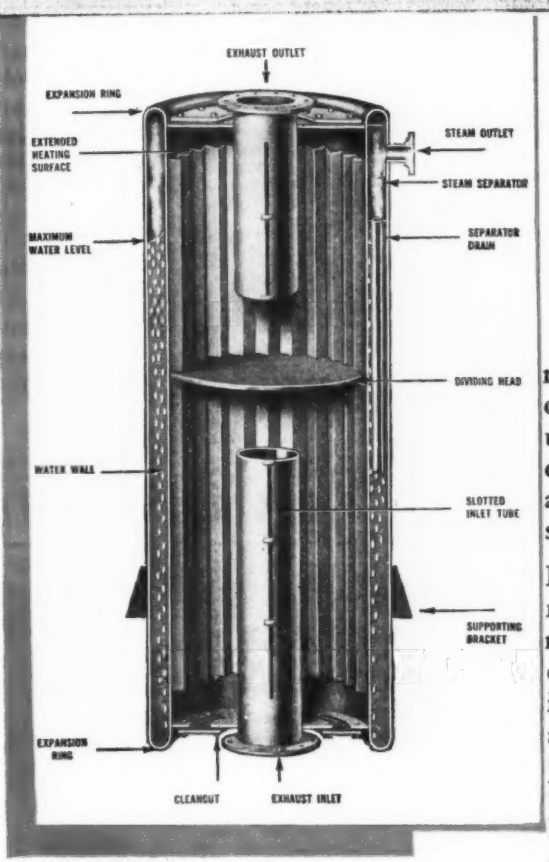
SAVE FUEL

PUT EXHAUST HEAT TO WORK WITH

MAXIM HEAT RECOVERY SILENCERS !

There are few industrial plants that would knowingly throw away fuel, and yet many do just that when they allow engine exhaust heat to escape without making use of it. Maxim Heat Recovery Silencers utilize exhaust heat to produce steam or hot water for heating or processing operations. They combine in one unit effective silencing of exhaust noise, spark arresting (where necessary) and efficient heat recovery.

From an efficiency point of view, the value of using Maxim Heat Recovery Silencers is obvious. Engine exhaust must be silenced as a matter of good public relations. The use of Heat Recovery Silencers accomplishes this and, in addition, produces "fuel-free" steam or hot water.

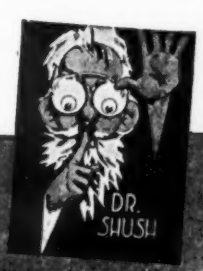


For silencing without the heat recovery feature, Maxim makes silencers for internal combustion engine exhaust or intake, steam engine exhaust, air compressor intake, vacuum pump discharge, blower intake and discharge, high velocity steam, air or gas discharge. Engine exhaust silencers available with or without spark arrestor. Bulletins on request.

Write for Bulletin

Bulletin WH-101 is an eight page illustrated folder showing various types of heat recovery silencers and also practical working hook-ups. A copy will be sent promptly on request.

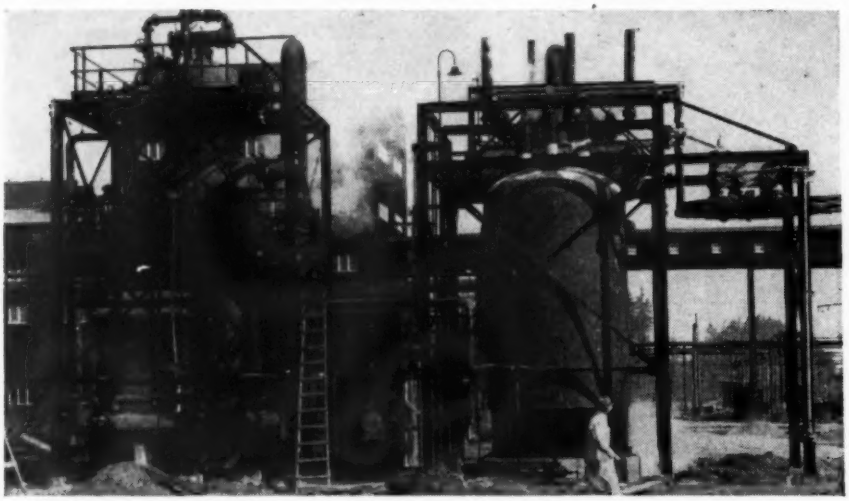
THE MAXIM SILENCER COMPANY • 92 HOMESTEAD AVE., HARTFORD, CONN.



ARMY E NAVY

MAXIM

WORLD'S LARGEST AUTOMATIC ELECTRIC BOILER



All steam requirements for operation of the Salem, Oregon, alumina plant are supplied by this Combustion Engrg automatic electric boiler. The boiler requires 50,000 kw to operate and generates 150,000 lb of steam per hr

automatic load-control devices and the carrier-current relaying of lines, and the extensive use of static capacitors to increase effective capacity of lines and transformers. Little of consequence was developed in the technology of steam or hydro generation, and the vast amount of hydro capacity installed developed nothing of a technological nature which would be expected to broaden the use of hydroelectric generation in postwar years.

Kwhr per kw output rose to new heights during the war under impact of "around-the-clock" operations in war plants, particularly those making aluminum and powder, but it has been dropping since last year and will continue to drop, even though it may never recede to prewar levels.

"Except in a few places," the spokesman declared, "we had no surplus capacity margin to speak of. In 1942 and 1943, we got by mainly by inter-connection and by not taking machines off the line for normal overhaul. In 1944 and thus far this year, these machines have had to be removed for maintenance and rehabilitation. Thus, while this year and last we have had proportionately more nameplate capacity than was available in 1942 and 1943, the capacity actually has not been available because of the number of machines down for maintenance."

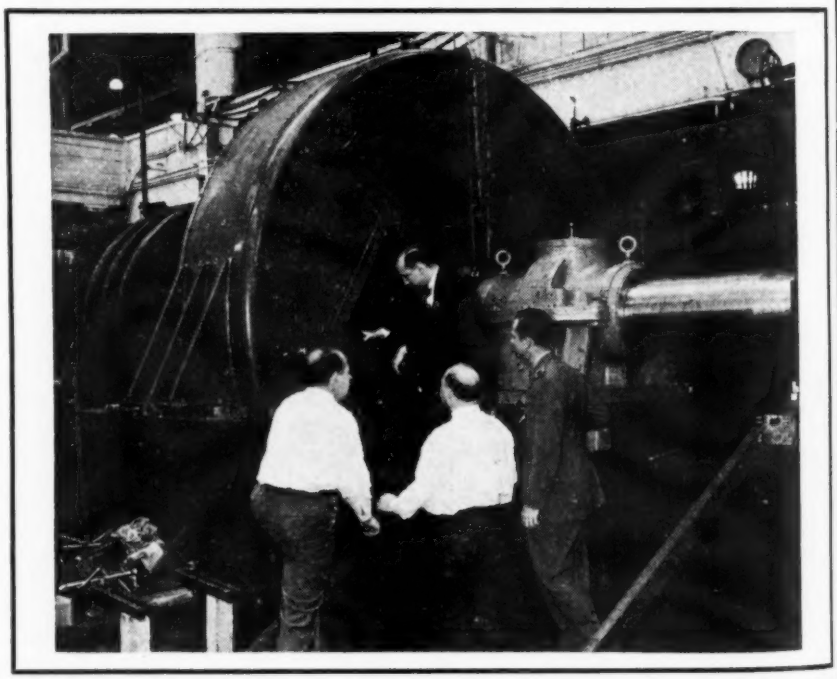
OWU's predecessor organizations of the early war period planned some large blocks of capacity for emergency loads, installing most of it in the Tennessee Valley Authority area or in the Northwest. The Manhattan District (atomic bomb project) used much of the spare capacity available in the Southeast and some of that in the Northwest. In the latter location all the spare capacity installed was not required.

It was the opinion of the spokesman that most of the interconnections ordered during the war period would be retained except those that might be dismantled to allow one or more participants to avoid the ownership of facilities used for transmission of energy in interstate commerce and consequent liability to jurisdiction of the Federal Power Commission. How many such interconnections are in existence is unknown. Throughout the war, FPC granted exemptions good for the duration, plus three to six months, to companies, not otherwise under FPC jurisdiction, which made connections that normally would put them under such jurisdiction. It was predicted that many of the interconnections so exempted would be retained under a clause allowing the existence of inter-connections involving ownership of interstate facilities for emergency use only, without the owners of the facilities involved becoming subject to FPC jurisdiction. Numerous interconnections between privately owned systems and municipal systems or industrial generating plants have been made, most of which survived the war.

It was conceded that where an inter-

(*Continued on page* 178)

NEW ELECTRIC DRIVE FOR MERCHANT SHIP



First commercial installation of Elliott Co's new Bowes Drive connects engine to ship's propeller shaft. Designed by Thomas D Bowes, naval architect and marine engineer, machine is a 2200-hp direct drive with a speed reduction, without mechanical gears, of 240/120 rpm. It will be installed in a Maritime Commission cargo vessel to reduce, by wholly electrical means, speed of engine to lower speeds required for most efficient operation of propellers

Alright Joe*—

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To eliminate scaling of heater tubes and the excessive use of exhaust steam for heating water, go to the source of the trouble—YOUR RAW WATER, with a complete water treatment service such as Nalco offers.

YES, JOE, to eliminate scaling of heater tubes and obtain more efficient heater operation and lower maintenance costs, your best bet is to properly condition the impurities in your raw water. You can do this with Nalco water treatment.

Nalco provides industry with a wide range of water treating chemicals and a complete follow-through program that helps banish the headaches that accompany untreated or improperly treated water. Step up your plant efficiency and lower your operating costs with Nalco water treatment.

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NATIONAL ALUMINATE CORPORATION

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* *Joe,* an operating engineer at a packing house says—
"Impurities in our city water and consequent scaling of heater tubes are causing us to use much exhaust steam for heating our water."
SOURCE—Survey conducted by well-known power publication.

Photo in Nalco Laboratories

Harvey Berg
Nalco Representative
Dayton, Ohio

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How Many "DEADBEAT" VALVES are hiding

Many valves, already veterans when the war began, have reached retirement age because of the strain of round-the-clock wartime operation. Nursing along these valves that are worn beyond the point of economical repair is throwing good money after bad.

They dribble away profits by requiring an excessive expenditure of maintenance time, labor and materials. They may fail at a critical period in processing, ruining large quantities of material controlled – or interrupt production when failure forces shut-downs for repair or replacement.

Now that the war has ended, and a plentiful supply of valves is in sight, management with an eye to future profits will plan early replacement of all the "deadbeats" on pipe lines.

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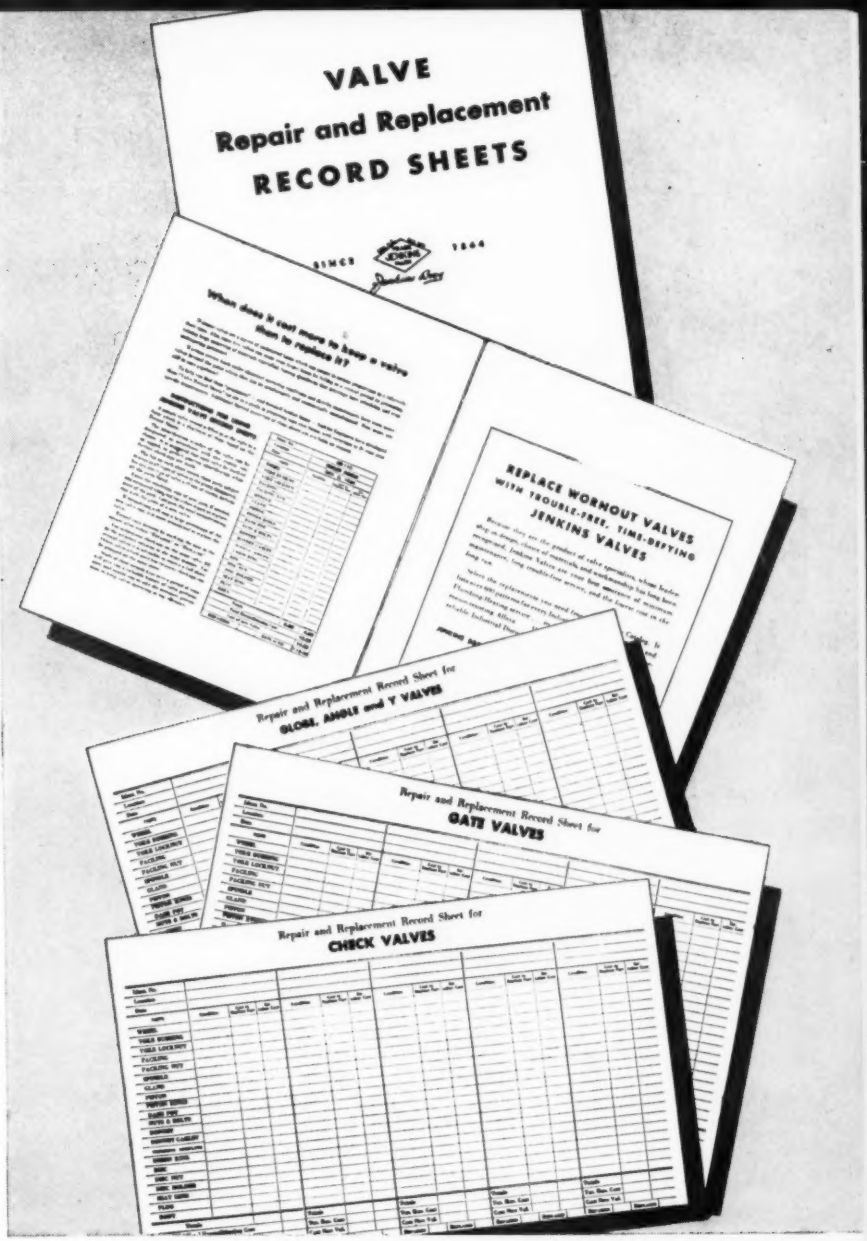
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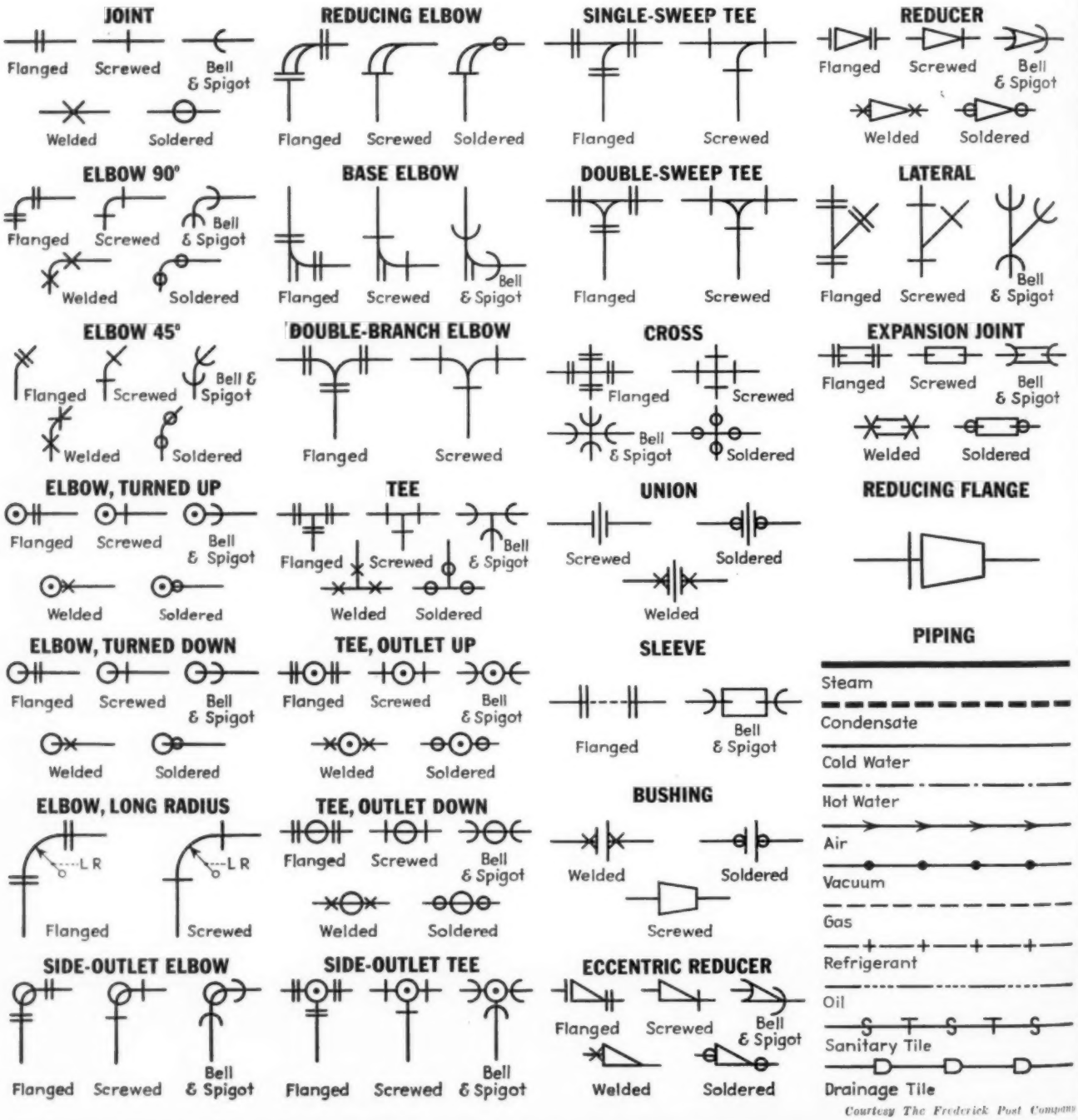
Number 158

Usual Symbols for Drawings - I

SCHEMATIC INDICATIONS on piping-system drawings vary widely with the individual taste of the engineer but certain conventions have come to be accepted practice. With some improvising, this set of symbols will serve for practically all ordinary power-service piping.



Courtesy The Frederick Post Company

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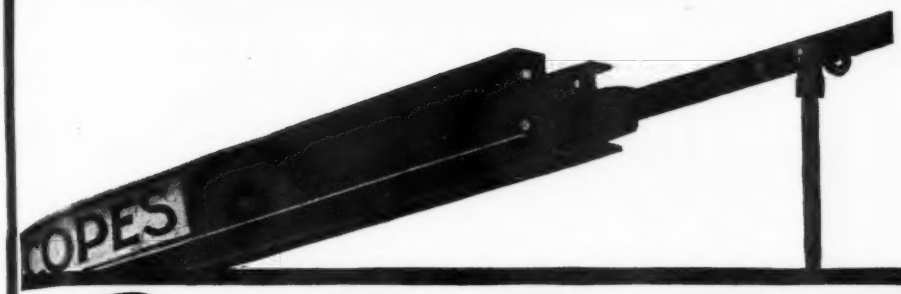

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Let's Be Practical . . .

The other day a lawyer neighbor of mine came over for help. His casement window wouldn't close so he'd taken off the operating crank and lever and brought it along. As you've probably already suspected the gear segment on the inner end of the lever was worn off. His attitude toward the designer of that operator was not complimentary, to say the least. Of course, he found as many things wrong with it as a horse trader does with somebody else's horse.

I didn't say much to him about it, but the incident set me thinking. The gadget, exposed to weather at least part of the time, was sealed against lubrication but not moisture. It had been greased when made eight years ago, but after installation couldn't be got at for maintenance. Operators on my windows are a different type, but are likewise impossible to get at.

Lord knows my neighbor isn't much of a mechanic, but he would have oiled that gadget if an oil hole had been provided. Then I remembered the popular better-class automobile of a few years back that had the stoplight switch inside the oil pan, so it cost $12 to fix a 25-cent switch that kept failing. And another model had the rear bumper hung on the body because the frame stopped at the axle. One bump and the tail telescoped. One car of mine had a steering wheel that came off in my hands, another some tricky front coil springs that popped out if you hit anything even lightly, dropping the engine onto the axle.

I have a toaster that's put together like a cheap metal puzzle—remove a couple of screws and the parts fly in all directions—yet you have to dismantle it to repair it.

We've had the same sort of thing in the plant: oil feeds without sight glasses; glands that leaked frequently, but took a gymnast to repack; handhole covers that wouldn't stay tight or wouldn't come off; brackets that worked loose or broke before the paint on 'em dulled, and so on.

It seems to me that too many designers aren't concerned with operation and wear—they can make a part good to look at and economical to build, but not suited to service. I remember once attending a lecture by an "expert" who had a doctor's degree. He had another doctor along to operate the slide projector. They couldn't get the machine to enlarge the slide more than four diameters, then they couldn't focus it—and when the room lights were turned out, the projector lights went out, too. A couple of us ordinary mortals who'd got the smell of grease on our hands finally had to figure out how the thing worked, then work it for the learned doctors so they could get on with the lecture. And after it was over, we agreed we'd have done better to profess complete ignorance of the projector and save everybody's time.

Those fellows just weren't practical. Too many like them are designing what we less learned but practical fellows have to keep running. There should be a requirement that every engineer supplement his books with a year's interneship in a plant—the more ordinary the plant the better!

George Edwards

Engineer

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THE RIGHT PACKING CUP FOR YOUR NEEDS

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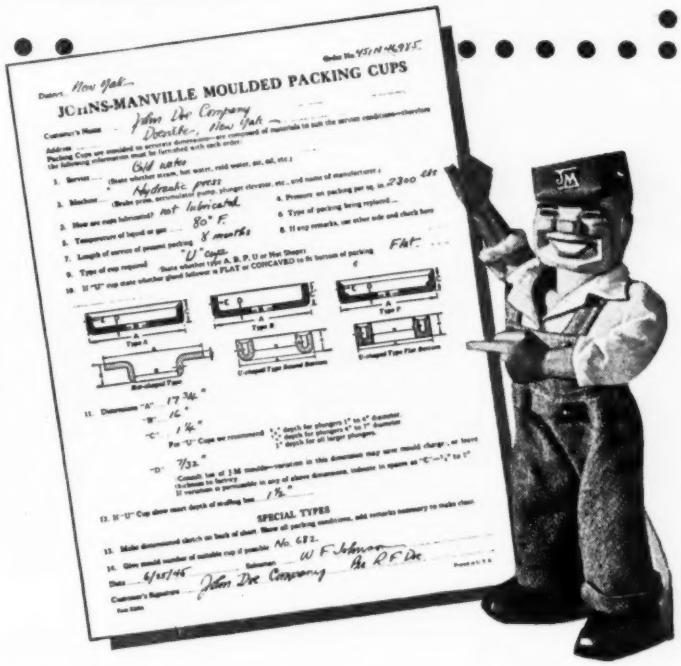
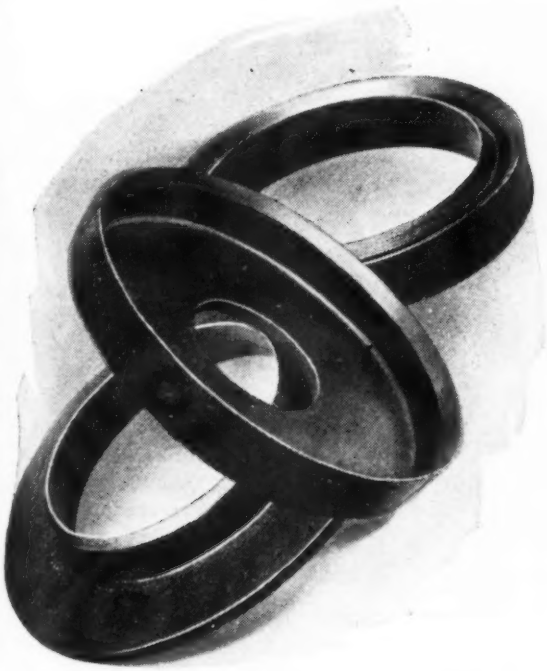
This simple data sheet can help you get increased packing efficiency. It supplies information from which Johns-Manville moulds packing cups to meet your specific needs. In terms of reduced costs and longer packing life, it will pay you to make use of this easy-to-fill-out form, obtainable from your J-M Packing Distributor.



2. WE TAILOR THE PRODUCT TO FIT THE JOB



From this information, J-M Moulded Packing Cups are "custom-tailored," moulded to your requirements in shape and size, as well as composition. This may vary, depending on whether they are to seal against air, water, steam, oil, etc., or to operate against high or low pressures and temperatures. The result is a packing cup that wears longer and provides a positive seal with minimum friction on all types of hydraulic and pneumatic equipment.

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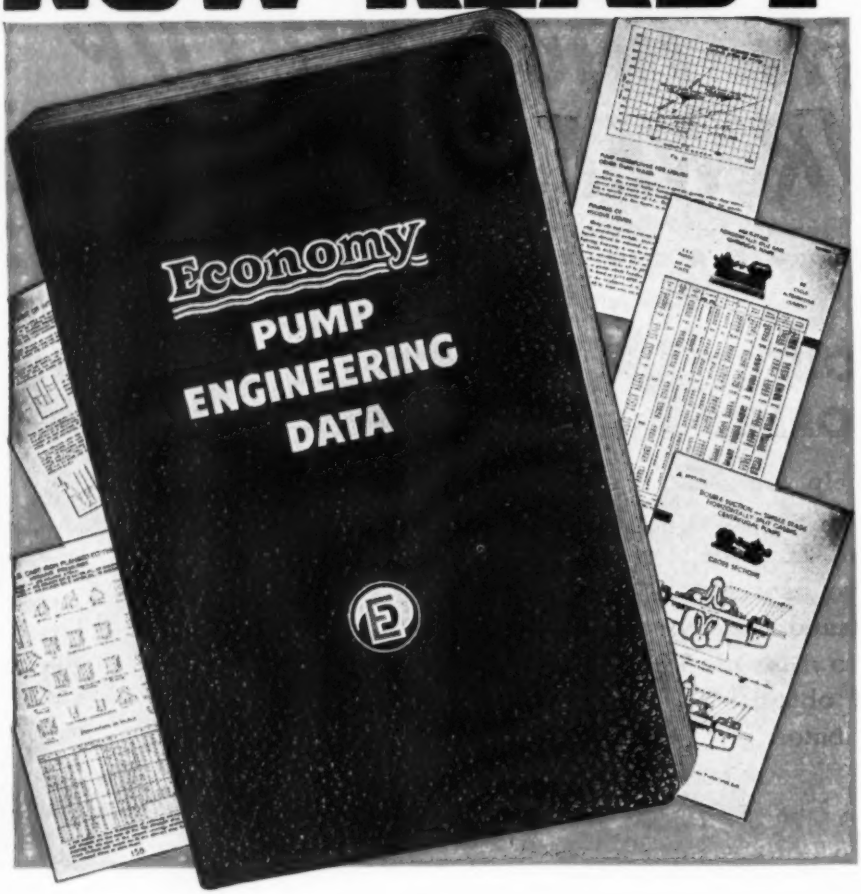

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Centrifugal Pump Q & A

(*Continued from page* 116)

minus the velocity head. That is, under conditions of Fig. 2 and 3, the gage reads low by an amount equal to the velocity head.

Q 16—Can a pump with a static suction head like Fig. 2 have a suction lift when operating?

A—Yes, particularly if the static suction head is comparatively low and the suction line long with several elbows. Then the sum of the entrance losses to the suction line and the friction losses in the line may be greater than the static head. Here pressure at the pump's suction nozzle is below atmosphere, not above, and the pump operates with a suction lift. If entrance and friction losses equal static suction head, we have the condition of zero suction lift or zero suction head.

Q 18—What is discharge head of a pump?

A—It is the head measured at the discharge nozzle, and can be expressed in absolute or gage pressure readings, or in feet head. It is the sum of the static discharge head, friction head for the capacity considered, the exit losses at end of discharge line and the terminal head or pressure expressed in feet of liquid being pumped. Discharge head is always measured from the pump's center line. A pressure gage connected into the pump's discharge, when its reading is corrected to the pump's center line, indicates the discharge head, minus velocity head at the point where the gage is connected.

Q 19—How is discharge head determined?

A—This depends on arrangement of the discharge piping. When pump discharges into a tank's bottom, Fig. 1 and 2, discharge head equals static head, plus friction losses from O_d to B, plus exit losses at B. In Fig. 3 discharge head equals static head, plus friction losses from O_d to B, plus exit losses at B, plus pressure-gage reading P.

While Fig. 4 represents an overhead tank with discharge above the tank, it applies to all cases of overboard discharge. Here discharge head equals static head D measured from the pump's center line to the highest point of the discharge pipe, plus friction losses from O_d to B, plus exit losses at B, as in Fig. 1. However the distance from the pump's center line to the discharge water level is less than the actual static

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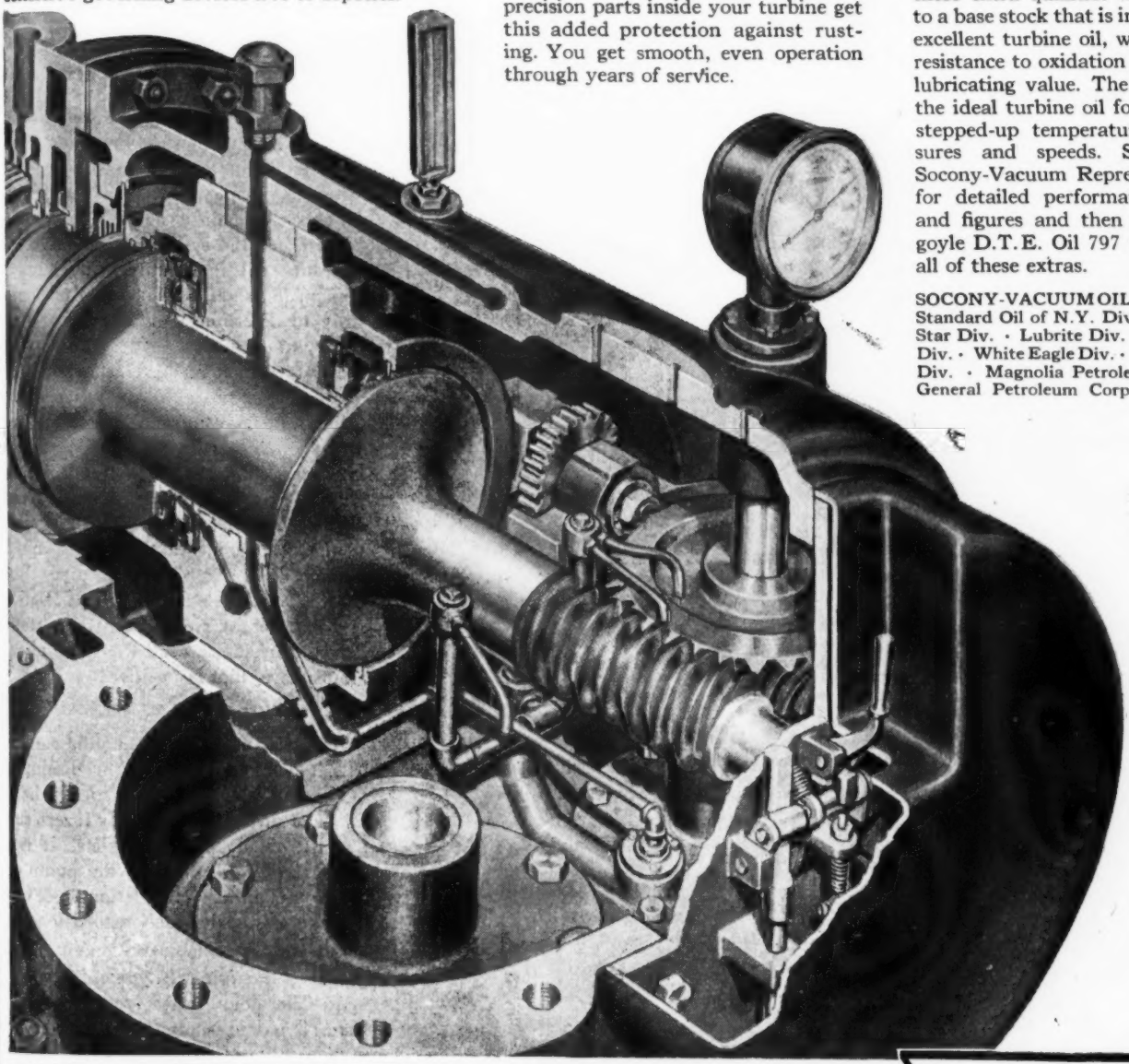

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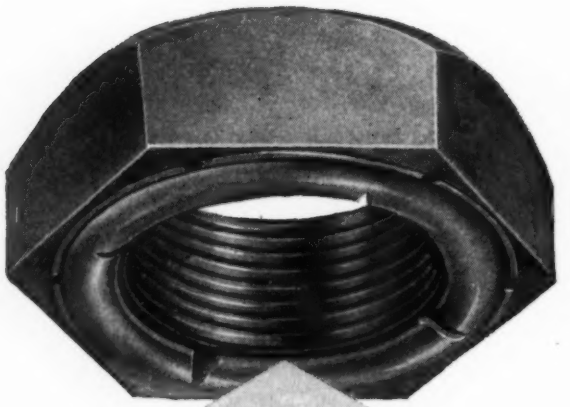

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discharge head. It is possible to recover all or part of this difference in static head by installing some form of syphon leg on the discharge. Fig. 5 to 7. While arrangement in Fig. 6 is the most efficient theoretically, it is frequently desirable to use an open discharge, as in Fig. 5.

Discharge head when the pump is in operation equals the static head, Fig. 5, D, as measured vertically from the pump's center line to B, plus total friction losses in the discharge piping, plus the exit losses at B. To operate, however, the pump must develop sufficient head to lift the water over the loop against static head D_1. Normally a pump selected for the head existing after it is in operation can start the liquid flowing over the loop. If there is any doubt about the pump being able to start the syphon, its head-capacity characteristic should be checked against the maximum static head D_1 of the system in which it will operate. All installations involving a syphon leg should be investigated carefully to determine how much head recovery to expect.

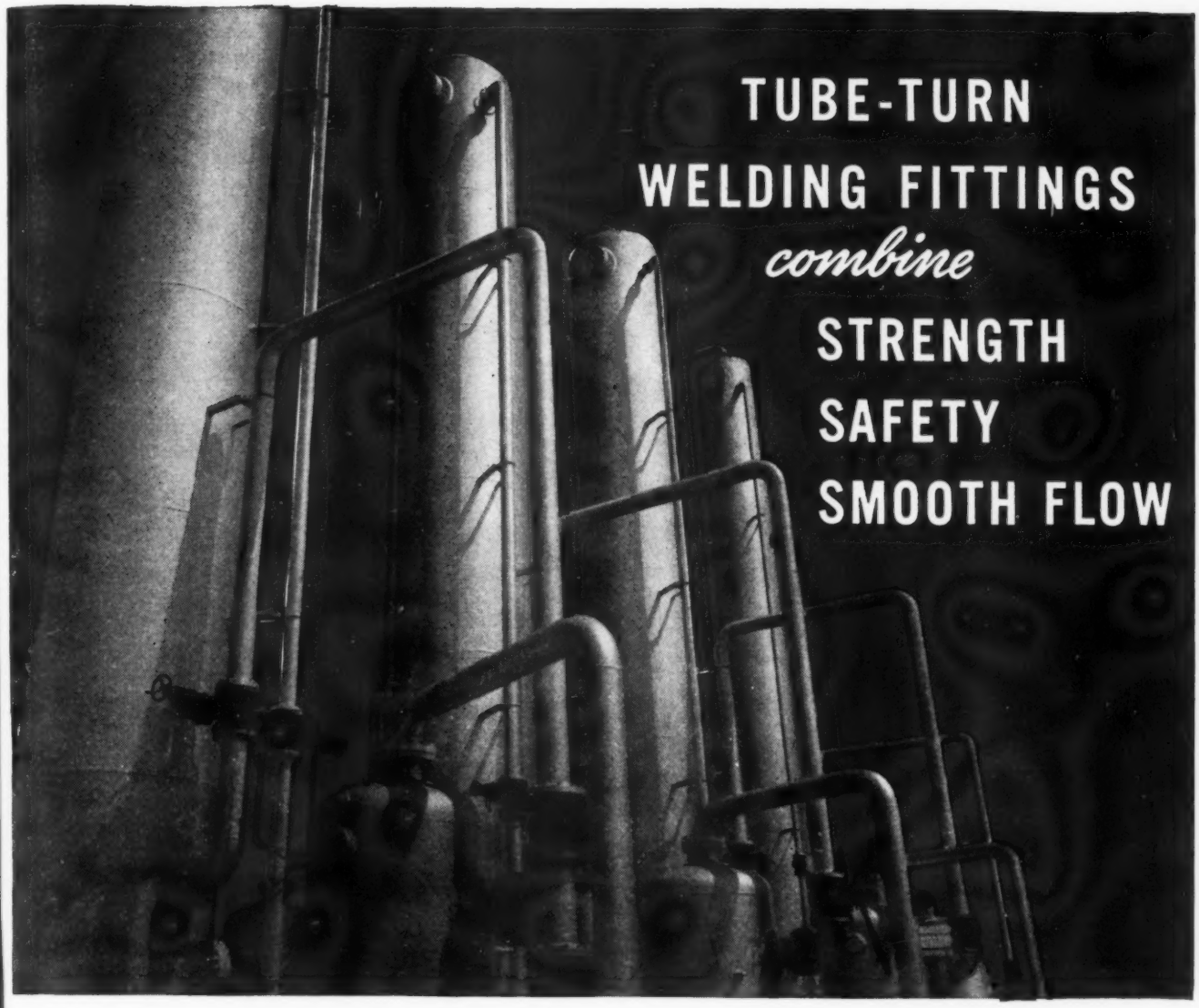
For condition in Fig. 7, pump is part of a syphon as in a condenser circulating-water system and serves to start and keep liquid flowing. Its discharge head may be negative, that is less than atmospheric, and is equal to static head, D, measured from the liquid's surface to the center line of the pump, minus friction losses in discharge pipe from O_4 to B, minus exit loss at B. If friction and exit losses are greater than static head D, discharge head would be above atmosphere, that is positive.

Q. 20—What is total head?

A—It is discharge head plus suction lift, if suction lift exists, or discharge head minus suction head if suction head exists, or discharge head only if zero suction lift or suction head exists. It is a measure of work done by the pump on the liquid, minus all friction losses in the pump from its suction to discharge nozzle.

Q. 21—What is total dynamic head?

A—The four terms, total dynamic head, dynamic suction head, dynamic suction lift, and dynamic discharge head, are no longer used. While total dynamic head referred to the head that is now called total head, dynamic suction head, dynamic suction lift and dynamic discharge head were defined as the heads measured by gage corrected to the pump center line, and thus did not include velocity head. This led to general misunderstanding if size of pump suction and discharge openings were not specified and resulted in different head values for pumps working



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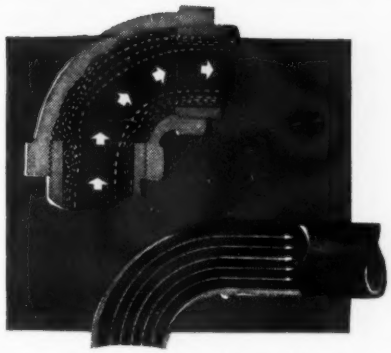

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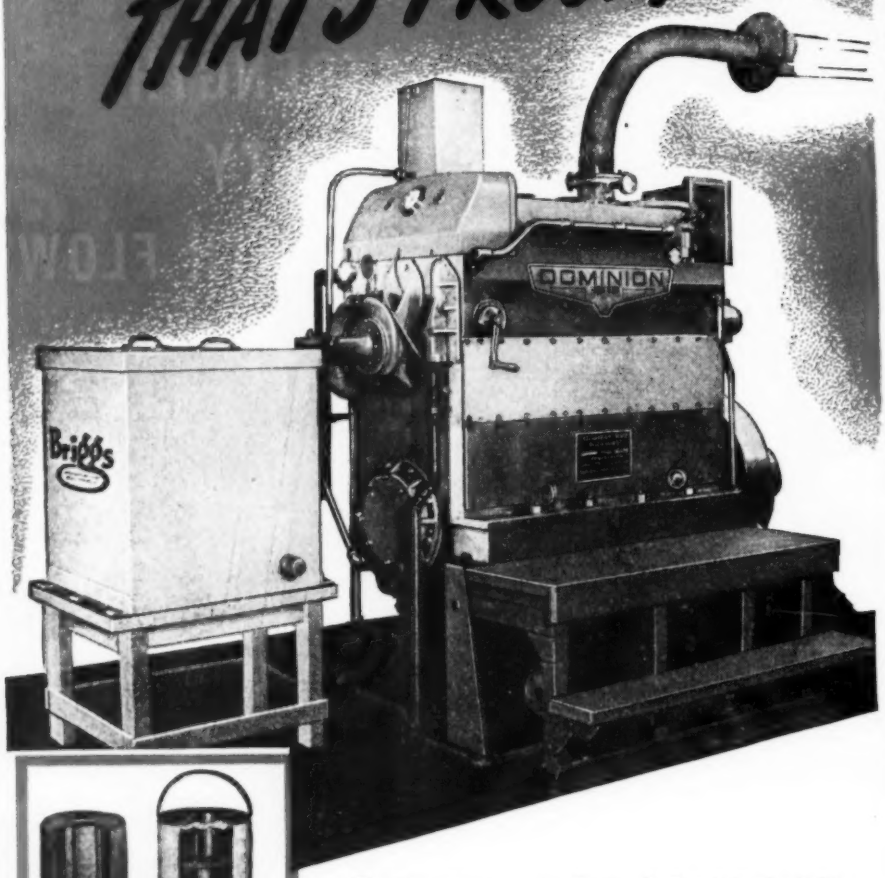

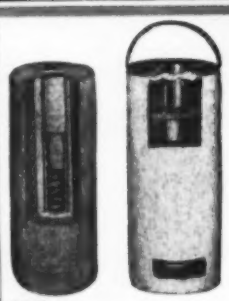

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If your Diesel is not equipped with a Briggs Oil Clarifier you're missing a good bet. Consult the Briggs Distributor nearest you and let him tell you how Briggs Lube and Fuel Oil Clarifiers are able to increase over-all efficiency and why they are a sound investment for you. *There is a Briggs Oil Clarifier for every size and type internal combustion engine . . . for every type oil.*

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under identical conditions when openings were not the same. Furthermore, in determining total dynamic head from dynamic discharge head and dynamic suction head, it was necessary to correct for any difference in velocity head. Present method of specifying heads is more satisfactory than dynamic-head method.

Reader's Problems

(*Continued from page* 113)

with the hot-water demand. As long as this demand is such that heat requirements exceed the heater capacity, including steam leakage, pressure on the water will be less than that on the steam side.

With no obstruction in the water line from the tank, pressure in the latter remains at the water supply pressure and when the heat input of the steam exceeds the requirements for supplying hot water, steam will leak into the water space and also be generated by water contacting the hot tubes. Thus water will be driven out of the heater and the system will fill with steam. If there is no steam leakage into the water space, maximum pressure that exists in a closed water tank will be the pressure of the steam on the coils.

Boiling point of water in a closed tank always corresponds to its pressure. It can boil at 212 F only at atmospheric pressure.

Piney River, Va. I A BUTCHER

Carryover May Contaminate Water

MANY WATER HEATERS are operated by introducing live steam into the water and this is the condition *PAH* now has. If the boiler water from which the steam is generated is highly treated and if there is any appreciable carryover with the steam, the water may be contaminated to the point where it is undesirable for personal toilet purposes. Any such difficulty could be readily determined by standard water tests.

Water in the tank will boil at a temperature corresponding to the water pressure, which means that when released from a faucet the water will immediately flash into steam. If the water is used for washroom purposes the condition would not only be unsatisfactory but also hazardous, as there would be great danger of the flashing steam scalding somebody.

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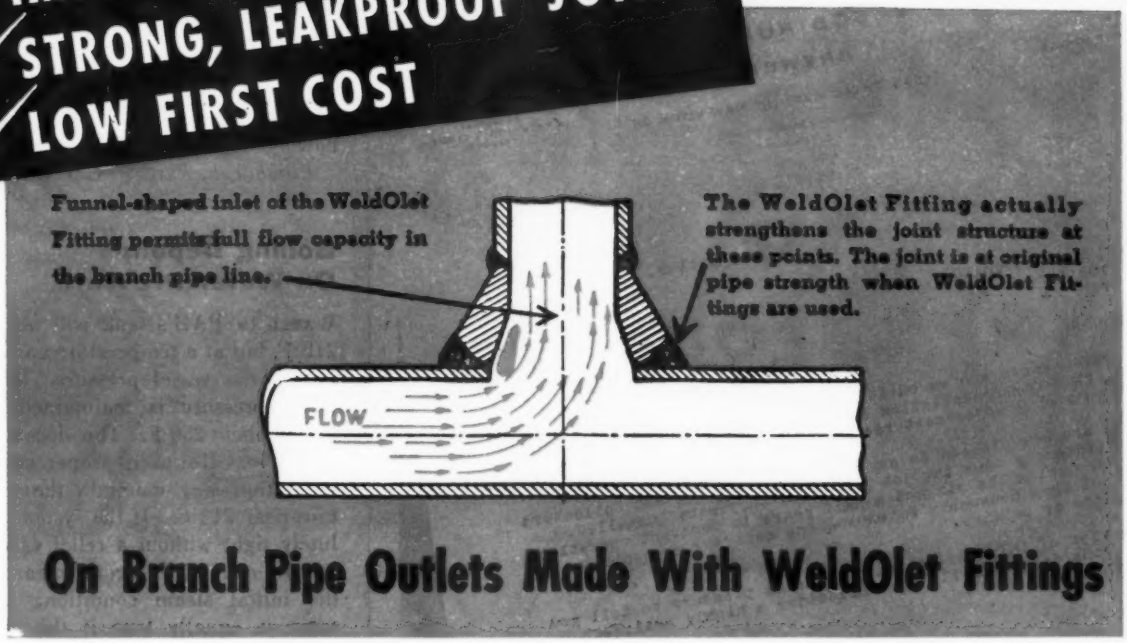
✓STRONG, LEAKPROOF JOINTS
✓LOW FIRST COST


Funnel-shaped inlet of the WeldOlet Fitting permits full flow capacity in the branch pipe line.
The WeldOlet Fitting actually strengthens the joint structure at these points. The joint is at original pipe strength when WeldOlet Fittings are used.
FLOW

On Branch Pipe Outlets Made With WeldOlet Fittings

This cut-away drawing shows a WeldOlet Fitting in place. It shows how you can get improved flow conditions and strong, leakproof joints on branch pipe outlets.

Find out how these fittings can give you better branch pipe outlets at less cost. It is easy to install WeldOlet Fittings. No templates are needed. You don't have to waste time forming and fitting the run and branch pipes. Ask for a copy of the WeldOlet Catalog. It contains complete information on the uses, applications and installation of WeldOlet Fittings. It shows you how to save time and money and insure better flow conditions on your next branch pipe outlet job. Drop us a line today.

WeldOlet Fittings are stocked for all standard pipe sizes in size-to-size and reducing sizes with outlets from ¼" to 12". Available with beveled outlets and socket outlets for welding and with threaded outlets for screwed branch pipes.

BUY MORE WAR BONDS AND KEEP THEM

Forged Fittings Division • BONNEY FORGE & TOOL WORKS • 342 Green St., Allentown, Pa.

WELDOLETS

TRADE MARK REG. U. S. PAT. OFF. PAT. IN U. S. & FOREIGN COUNTRIES

WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET

For Welded Branch Pipe Outlets

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BREWERY
1639 THIRD AVENUE, NEW YORK 28
TELEPHONE ATWATER 9-1000

GEORGE E. RUPPERT, PRESIDENT
J. RUPPERT SCHALK, VICE PRESIDENT
H. GARRISON GILLECK, JR., SECRETARY
FREDERICK M. LINDER, TREASURER

Buell Engineering Co., Inc.
70 Pine Street
New York, N. Y.

April 9, 1945

Gentlemen:

Seven years ago we built our power plant. When we were considering the installation of a system to collect fly ash, our engineering department recommended Buell equipment.

We are now pleased to say that the Buell Fly Ash Collectors have efficiently done the job for which they were installed. Moreover, during the six and a half years in constant operation, it has not been necessary to expend one cent for mechanical maintenance or repairs.

In view of this performance, it is my pleasure to tell you that we consider Buell Fly Ash Collectors a highly satisfactory plant investment.

Very truly yours,
JACOB RUPPERT

GER: H

George E. Ruppert
President

• BUELL DUST RECOVERY SYSTEMS are used throughout industry in the collection or reclamation of many kinds of dust, in numerous production and process operations.
Hundreds of satisfied industrial users will attest to Buell's—
"High Efficiency, Low Maintenance, Long Life."

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DUST RECOVERY SYSTEMS

BUELL ENGINEERING COMPANY, INC.
70 Pine Street, New York 5, N. Y.
Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

maximum pressure that can be built up in the tank by the 40-psi steam would be 40 psi.

The system as now arranged could be made to work satisfactorily by installing a temperature controller whose operation is such that when the water temperature in the tank reaches a predetermined point, say 180 F, controller actuates a valve to shut off the steam flow.

Pittsburgh, Pa. C J WYROUGH

Boiling Depends On Water Pressure

WATER IN PAH's tank will not boil at 212 F, but at a temperature corresponding to the vessel pressure. If 15-psi water pressure is maintained, it will boil at about 250 F. This does not seem excessive. However, proper steam-flow regulation may maintain the temperature near 212 F. If the system is absolutely tight without a relief valve, tank failure can easily occur regardless of the initial steam condition; but the same is equally true if the steam is separated from the water by the heating coil walls.

W. New York, N. J.
ANTONIO DI LORENZO

Fluorescent Flashing

(*Continued from page* 102)

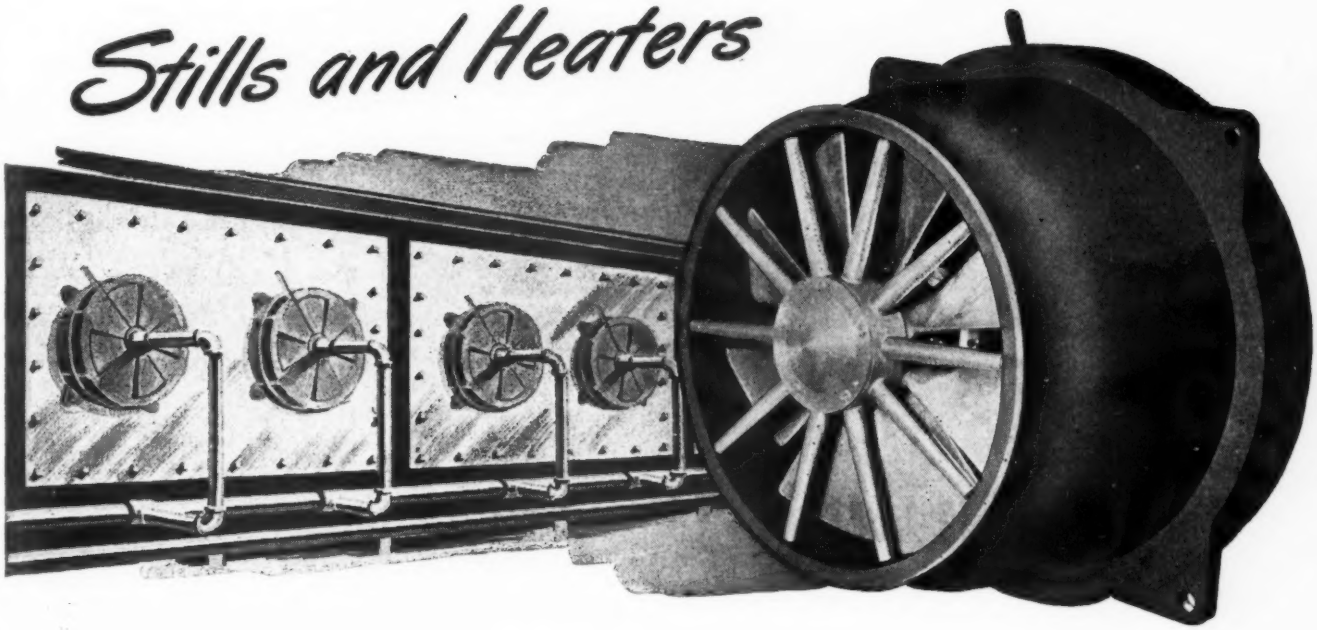
fault lies in the ballast, it is generally impracticable and usually impossible to repair it, and a new one should be substituted.

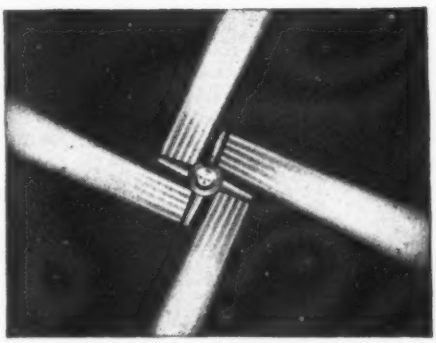
At the end of the lamp's useful life it is no longer possible to boil off enough electrons from the meager supply of emissive material left on the cathodes, when preheat starting current is impressed across the lamp. Since there are not enough electrons surrounding the cathodes to ionize the gas within the tube, the lamp will not start with the available voltage surge when the starter switch opens.

Satisfactory starting may be obtained by impressing a higher preheat current across the lamp, but this maneuver is usually impracticable. A higher starting voltage will also start the lamp and this has led to the development of high-voltage transformers often sold on the basis that fluorescent lamps can still be burned after they fail on standard ballasts. These devices pull electrons from the cathodes at such a high rate of speed that they traverse the tube length, ionize the gas, and

"BUNSEN'S DREAM" UPS THRU-PUT OF

Stills and Heaters





Bunsen, developer of the first gas burner, believed that "An ideal gas burner is one in which there would be an infinite number of gas orifices interposed across the air stream." And that is as close a description as you could get of the Coppus-Dennis FANMIX Burner.

The exclusive "pinwheel action" principle of FANMIX produces a perfectly combustible mixture of air and gas that results in:—

1. Complete combustion with less than 5% excess air.
2. Greater heat release.
3. Total absence of drifting "hot spots"

Here's how FANMIX works. Fuel escaping from orifices in rotating driver arms, rotates the fan which draws in air at right angles to the path of the fuel. The energy of the fuel under pressure is utilized to perform work by mechanically mixing and proportioning the fuel with just the required amount of air.

Increase Rating of Old or New Equipment

Coppus engineers FANMIX Burners for individual application. Complete control over rate of combustion or flame pattern can be provided to meet requirements of any installation. Straight gas and combination gas-oil burners available; combination burners burn either oil or gas in entirety or in any proportion. No oil guns needed.

Send for the Coppus-Dennis FANMIX Bulletin 410-4. Coppus Engineering Corporation, 186 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

On New Installations, Fanmix Saves

1. **COMBUSTION SPACE.** With FANMIX the furnace does not have to serve as a mixing chamber.
2. **STACK HEIGHT.** With FANMIX there is no draft loss across the burner.
3. **INSTALLATION COSTS.** With FANMIX you can use smaller pipe sizes, need no forced draft equipment, etc.

More than 93% of 191 petroleum refinery plants built for war, use Coppus equipment.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
170 Park Ave.,
Worcester 2, Mass.

FREE BULLETIN

Please send Bulletin 410-4 to

Name.....

Company.....

Address.....

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IN THE INTERESTS OF

FUEL CONSERVATION

Guardian of Your Fuel and Comfort

The War Production Board says we've got to save 5,000,000 tons of coal this year. This gives steam plant owners a choice of two moves—either cut down on heating *or modernize for greater efficiency!*

Modernizing with Hoffman Steam Specialties is a proved way to get the same amount of heat from less fuel. Since 1913, the Hoffman Policeman trademark has symbolized fuel-saving efficiency.

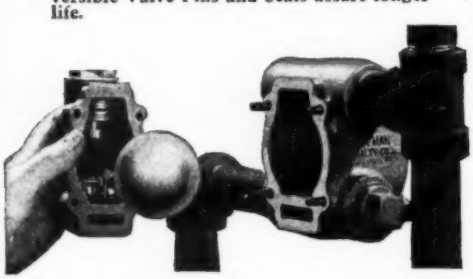
It is a simple matter to restore run-down steam plants. By using Hoffman Traps, for example, to replace those units which are not giving satisfactory service, you are assured of full steam utilization and hence conservation of precious fuel. These traps have Thermostats made of non-corrosive metals, long-lived in spite of countless flexings and high temperatures.

Hoffman Traps are so constructed that all parts subject to wear can be easily and inexpensively renewed—no need to junk an entire unit because of a worn seat. Send today for literature on Hoffman Valves, Traps and Pumps . . . and remember that Hoffman engineers are always available for consultation on your heating problems.

Send today for latest catalog of Hoffman Low, Medium and High Pressure Traps.

HOFFMAN NO. 8 H TRAP
A bronze-bodied unit for pressures up to 125 lbs.

HOFFMAN 50 SERIES TRAP
This heavy duty trap does a precision job under toughest service. All working parts are mounted on the cover—*easily removed for cleaning without breaking pipe connections.* Reversible Valve Pins and Seats assure longer life.



TESTED AT EVERY STEP
The rigorous inspections and tests applied to Hoffman Specialties are your warranty of satisfactory performance on the job.

HOFFMAN

VALVES • TRAPS • PUMPS

HOFFMAN SPECIALTY CO., 1001 YORK ST., DEPT. P-10, INDIANAPOLIS 7, IND.

Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
Sold by leading wholesalers of Heating and Plumbing Equipment.

operate the tube. This is analogous to the operation of cold-cathode sign tubing where 12,000 to 20,000 v pull electrons from a soft-iron cathode.

However, there is a rather strong argument against using higher than normal starting voltages as activators for burned-out or failed fluorescent lamps. At the end of normal life the luminous efficiency of the average fluorescent lamp has dropped at least 25% of its initial value. Therefore, if a 30% drop in efficiency is the only argument for group replacement, we have only 5% to lose in light efficiency because of dust and dirt accumulation and outages. In the normal establishment, where lamps operate on an average of at least 2500 hr before failure, dust and dirt accumulation amounts to at least 5%, and generally much more. Therefore, economic common sense dictates that high-voltage starting units should not be used as *graveyards* for normally deactivated lamps.

Full Use of Log Sheet

(*Continued from page* 76)

3-way cock to atmosphere for starting main compressor. Open the return valve on the fuel-pump oil line, close the turbine throttle valve and open turbine drains. Then close burner oil valves, close boiler dampers and pull burners out part way. Shut down oil pump. Close main steam valves on boilers. Open flash-tank valves and shut down main feed pump. Close the damper and shut the valve on the air line to reducing-valve diaphragms. Open drains on testing drums.

"On entering the boiler room to start up a boiler, find true water level by using trycocks and blowdown on water columns. Then clean the burners and open return oil valves, making sure that burner valves are closed. Start oil pump, electric heater and portable compressor, which regulates reducing-valve diaphragm. Open two main valves on boiler. Then close heater valve and bleed steam line to feedwater pump and crack throttle valve. Open the damper on the boiler and bleed turbine line to start turbine.

"If by that time oil temperature has reached 140 F or higher, light off No. 1 burner, and then No. 2. Following that, regulate damper to give 0.15-in. furnace pressure. If oil temperature in preheater has reached 180 F, turn off electric heater. Blow down boiler

CHAPMAN LIST 960

SMALL GATE VALVE

The threads on the improved List 960 are quick-acting. They permit fast opening and closing—will not stick or freeze.

The valve can be repacked under full pressure, as no pressure is transmitted to the stem.

Seats and plugs can be supplied super-hardened for extra severe services.

Chapman List 960 is made in sizes from ¼" to 2"—carbon steel for pressures to 800 pounds; alloy steel for pressures to 1000 pounds at 750°F. For higher pressures, specify List 990.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

SCHRAMM OFFERS THESE

Exclusive

COMPRESSOR-ECONOMY FEATURES

Four features make Schramm Air Compressors ideal for industry. They are: (1) 100% water cooled (2) compact—lightweight. (3) mechanical intake valve (4) forced feed lubrication. These features enable you to do your job quickly, easily, economically.

Schramm Compressors are designed for heavy duty, continuous service, with minimum attention. They are built in sizes ranging from 20 to 600 cu. ft. displacement, in every type of mounting and assembly.

Other Schramm features include long life discharge valve, and smooth, vibrationless operation. Make your compressed air job *easier* by using Schramm. Write today for details in FREE booklet just published.

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

This Stands for Honorable Service to Our Country

according to feedwater analysis and use soot blowers as required.

"Besides taking care of boilers my duties include keeping boiler and compressor room clean, polishing all brass and keeping all equipment oiled and wiped clean. I must make sure to record on the log sheet each of my actions and all occurrences in the boiler room."

We have found that this relatively simple method of training, plus the regular use of a log sheet, results in definitely improved operation, which shows up in better performance and lower costs.

Plant Studies

(*Continued from page* 71)

mitted to keep down fumes and odors; and steam consumption is reduced.

Building is air-conditioned from roof to basement and steam-consumption sheets are interesting because they show that only slightly less steam is required for heating than for air conditioning—air tempering and operating a Carrier 400-ton steam-driven centrifugal compressor. Tiffany & Co, one of the first organizations to release their air-conditioning compressor for war work, now has a used 130-ton machine that will serve until new equipment is available.

To keep monthly steam consumption below previous peak demand, each month's quota is divided into an average amount for each day. This figure is printed on a card in large numerals and attached to the steam meter so that the attendant can check actual daily usage against the budgeted amount. If several days of extreme weather run the steam consumption above the allowance, every advantage is taken of moderate weather to cut the amount used to the bone. An automatic cycling controller, acting on the direct-radiation pressure-reducing valve prevents heavy steam inrush to the cold piping by timing the valve movement. Movable arms on timer cylinder can be adjusted to lengthen or shorten the valve's open period.

New internal-combustion-engine lubricant contains no petroleum oils. The lubricant can be manufactured to any desired viscosity and is wax free. Pour points vary from —30 to —80 F. Flashpoints range from 300 F up. Carbide & Carbon Chemicals Corp, manufacturers of the lubricant, claim that carbon residue values are less than 0.01%, regardless of viscosity.

Slickest *"escape act"* on earth!

NATIONWIDE DISTRIBUTION—Warehouse stocks of the broad Carey Line provide service regardless of job location.

CAREY INSULATION ENGINEERING SERVICE makes available the knowledge and experience of leading authorities.

You can't beat a BTU for getting out of places. Bare piping, for example, is his dish. Proper insulation is his nemesis.

It isn't a question of needing industrial insulation. It's what kind will most effectively solve your particular heat loss problems.

Your surest solution lies in (1) a broad line of types, forms and shapes of insulation and (2) the engineering experience and resourcefulness to determine the one best insulation or combination for your job. Carey can deliver both—has been doing it for over 50 years.

For information on Carey Heat Insulations and Engineering Service write—

TRAINED ERECTION AND SERVICE CREWS "make sure" the job is done right.

BROAD LINE FROM ONE SOURCE. No need to compromise with desired results. You get the *right* insulation for the job.

Carey

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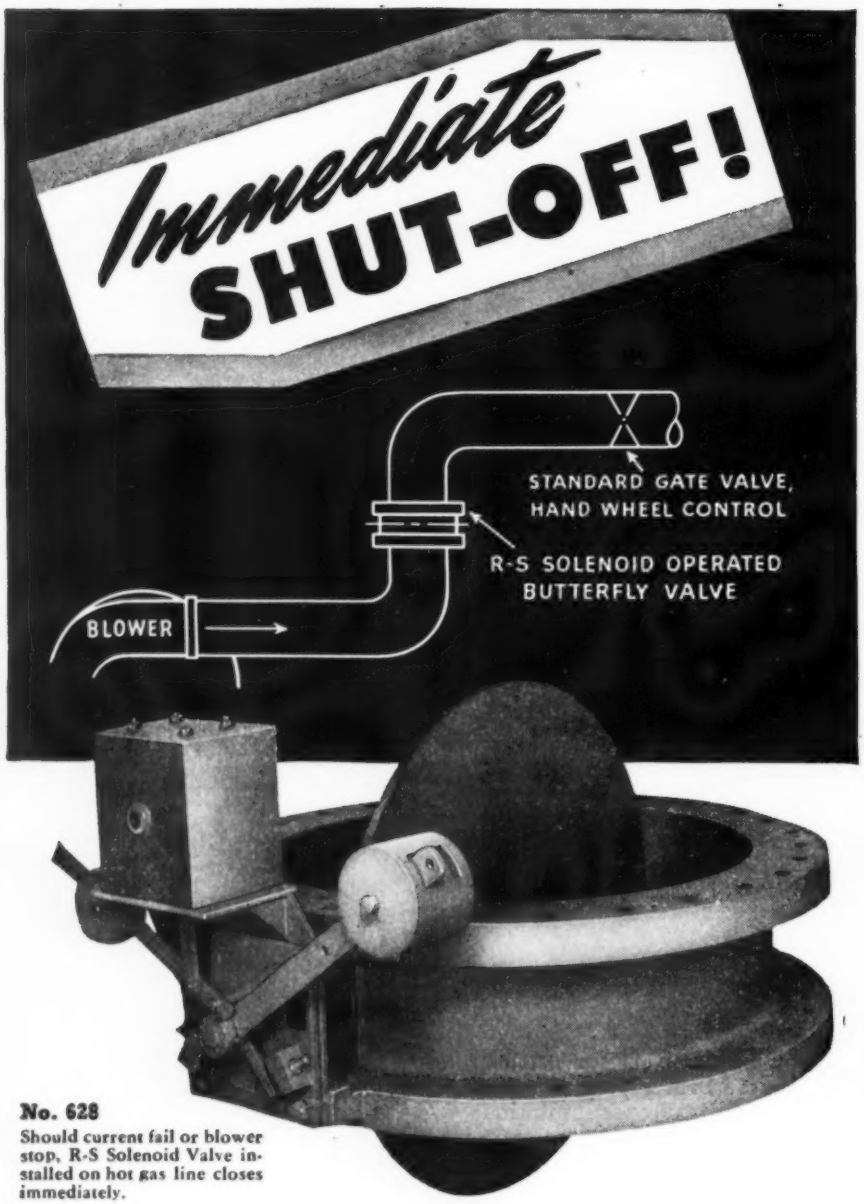
Careyduct • Industrial Insulations • Rock Wool Insulation • Asbestos Shingles and Siding • Asphalt Shingles and Roofings
Built-up Roofing • Roof Coatings and Cements • Waterproofing Materials • Asphalt Tile Flooring • Pipeline Felt
Expansion Joint • Asbestos Wallboard and Sheathing • Corrugated Asbestos Roofing and Siding • Miami-Carey Bathroom Cabinets and Accessories



No. 628
Should current fail or blower stop, R-S Solenoid Valve installed on hot gas line closes immediately.

The R-S Solenoid Trip Valve is used for emergency service. The solenoid can be arranged with the counterweight mechanism to open or close the valve and hold it there in one position or the other. If for any reason the solenoid functions, the latch is tripped, which permits the counterweight to open or close the valve by gravity. The assembly is suited to shut off the flow or to open a vent and requires manual reset. Can be constructed of any metal or alloy and in various sizes for air, gases, steam, oil, hydraulic and other services.

State your requirements and ask for Catalog No. 14-B.

R=S
QUALITY PRODUCTS SINCE 1908

15 to 900 psi, for air, gas, steam, liquids and semi-solids.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Ave. • Philadelphia 44, Pa.

R=S Streamlined BUTTERFLY VALVES

Engineer's Bookshelf

(*Continued from page* 122)

mented and supplementary material added in the section on water flow in pipes. All existing codes, dimensional standards and material specifications for piping abstracted in the earlier editions have been revised to date and abstracts added for those formulated since.

To improve the book's usefulness, tables and charts have been revised, additional authorities cited, more cross references provided and the index augmented.

Booklet Reviews

PHYSICAL AND CHEMICAL PROPERTIES OF PENNSYLVANIA ANTHRACITE *Available, without charge, from Anthracite Industries, Inc, 101 Park Ave, New York 17, N. Y. 26 pp.* Booklet represents a technical digest of a number of research studies and standards on Pennsylvania anthracite. It promotes a better understanding of potential value of the product for both fuel and non-fuel uses.

WHAT THE FOREMAN NEEDS FOR SUCCESS *Pub by National Foremen's Institute, Inc, Deep River, Conn.* 16 pp, 25¢. Pamphlet outlines methods for acquiring ability to supervise. It emphasizes the fact that not only must the foreman be a production expert, but he must also know how to handle various personalities.

THE LUBRICATION OF AUTOMOTIVE DIESEL ENGINES *Available to equipment maintenance men, without charge, from Gulf Oil Corp, Gulf Bldg, Pittsburgh, Pa.* 50 *pp.* Booklet explains how intelligent selection and use of lubricants and fuels for automotive diesel engines can contribute enormously to satisfactory operation.

HOW TO TRAIN YOUR ASSISTANTS *By Richard W Wetherill. Pub by National Foremen's Institute, Inc, Deep River, Conn.* 20 *pp,* 25¢. Manual on development of trained assistants tells about the formula, how it is used, why it works and when to apply it.

WHERE DO WE GO FROM HERE *Available, without charge, on request to Allis-Chalmers Mfg Co, 569, Milwaukee 1, Wis.* 16 *pp.* New training brochure No. E6085-A outlines a complete engineering graduate training course by Allis-Chalmers, in cooperation with Illinois Institute of Technology, permitting exploration by the graduate engineer of production, sales, research, design, field work, administration and many other elements of industrial operation.

Test engineers at one electrical manufacturing plant have kept a turbine bucket vibrating for 15 years, putting it through 100 billion vibrations.

Pull-chain lampholder is a small, compact device, but it takes 82 separate operations to assemble its 30 parts.

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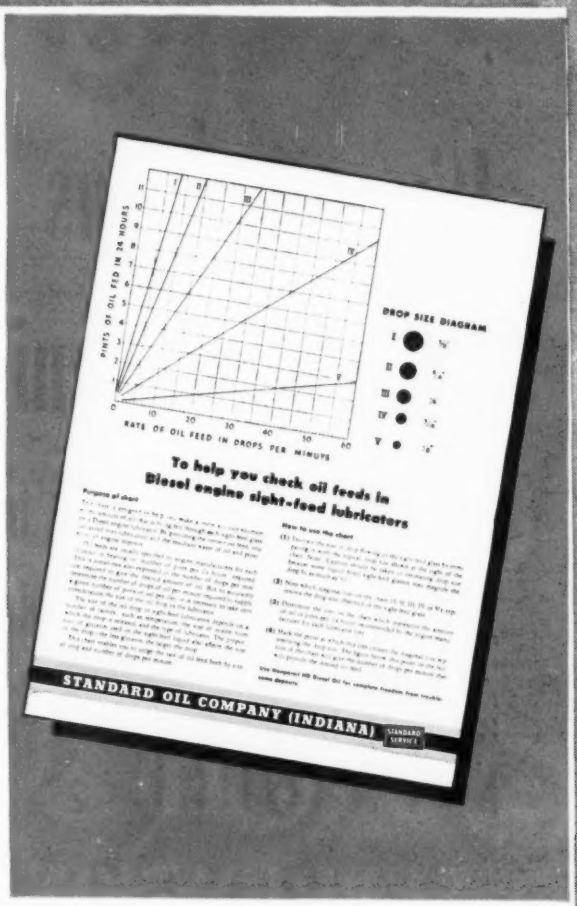
Check oil feeds to check wear and deposits . . . use

NONPAREIL HD
DIESEL OIL


PINTS OF OIL FED IN 24 HOURS
RATE OF OIL FEED IN DROPS PER MINUTE
DROP SIZE DIAGRAM
To help you check oil feeds in Diesel engine sight-feed lubricators
STANDARD OIL COMPANY (INDIANA)

Over lubrication or too little lubrication can be equally troublesome. The first may waste oil and cause excessive deposits. The second usually results in increased wear. Here are two ways to help you avoid all of these troubles.

The chart at right is designed as a guide in adjusting the oil feed in sight-feed lubricating systems. It enables you to check the amount of oil being fed to various engine parts by the size of the drop and the rate of flow in drops per minute.

With the right oil feed and Nonpareil HD Diesel Oil you can eliminate troublesome deposits and excessive wear. The book illustrated tells why the unusual oxidation inhibitor and detergent additive in Nonpareil keeps engines clean, rings free, and maintenance down on some of the most hard-worked, heavily loaded industrial Diesels.

You can get both the chart and the booklet without obligation by writing Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

This chart in full size is available to all Diesel engine operators. It will enable you to obtain a more accurate estimate of the amount of oil fed to Diesel cylinders and other engine parts. With it you can adjust oil feeds by the size of drop and the rate of flow in drops per minute. It will be helpful where engine manufacturers' recommendations simply state the amount of lubricant required in each 24 hours or where you want to check oil feeds in old lubricators.

Both the chart and booklet will be sent to you without any obligation. Simply write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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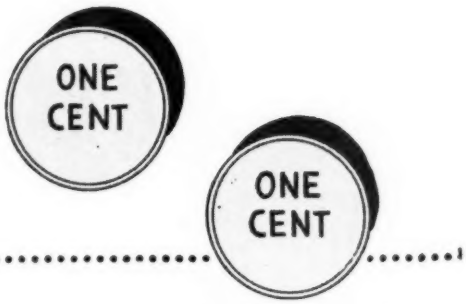
It's as easy as matching pennies



to get the right lubricant in the right places with Standard's

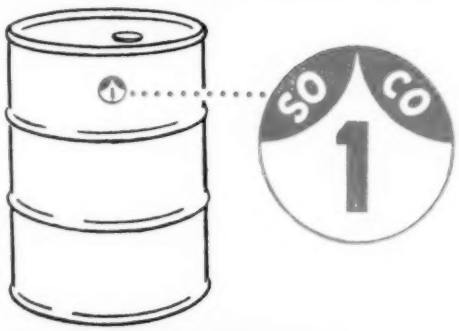
CODED LUBRICATION

• WITH Standard's Coded Lubrication, lubricants are handled from the drums or storage containers to oil cans or grease guns to the oil cups or grease fittings on equipment—by simple code numbers to identify them. It's easy to see how this eliminates the confusion of brand names and grades which your oiler must know—how it reduces the possibility of errors and the misapplication of lubricants which may result in damaged equipment or in applying expensive lubricants where they are not needed.

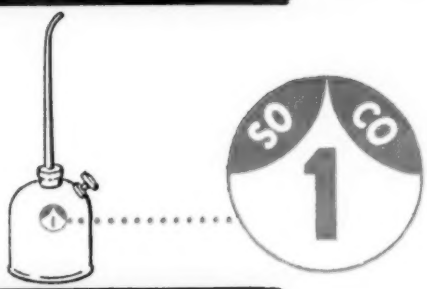
To install this system, you assign numbers to the lubricants used in your plant. Standard Oil will supply the numbered decals to be applied to the containers and lubricating spots. Now, when reconversion is in full swing, is a good time to plan on better, cost-saving lubrication.

A Standard Oil Lubrication Engineer will be glad to give you further information or consult with your lubricating men in the application of Coded Lubrication in your plant. This offer is available to all plants in the Middle West. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

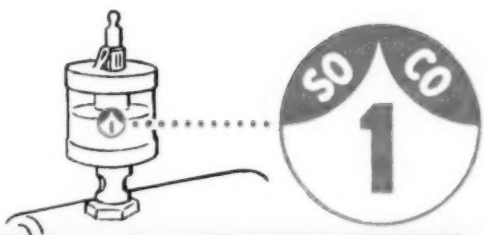
From storage container...



to oil can...



to oil cup...



by matching the numbers

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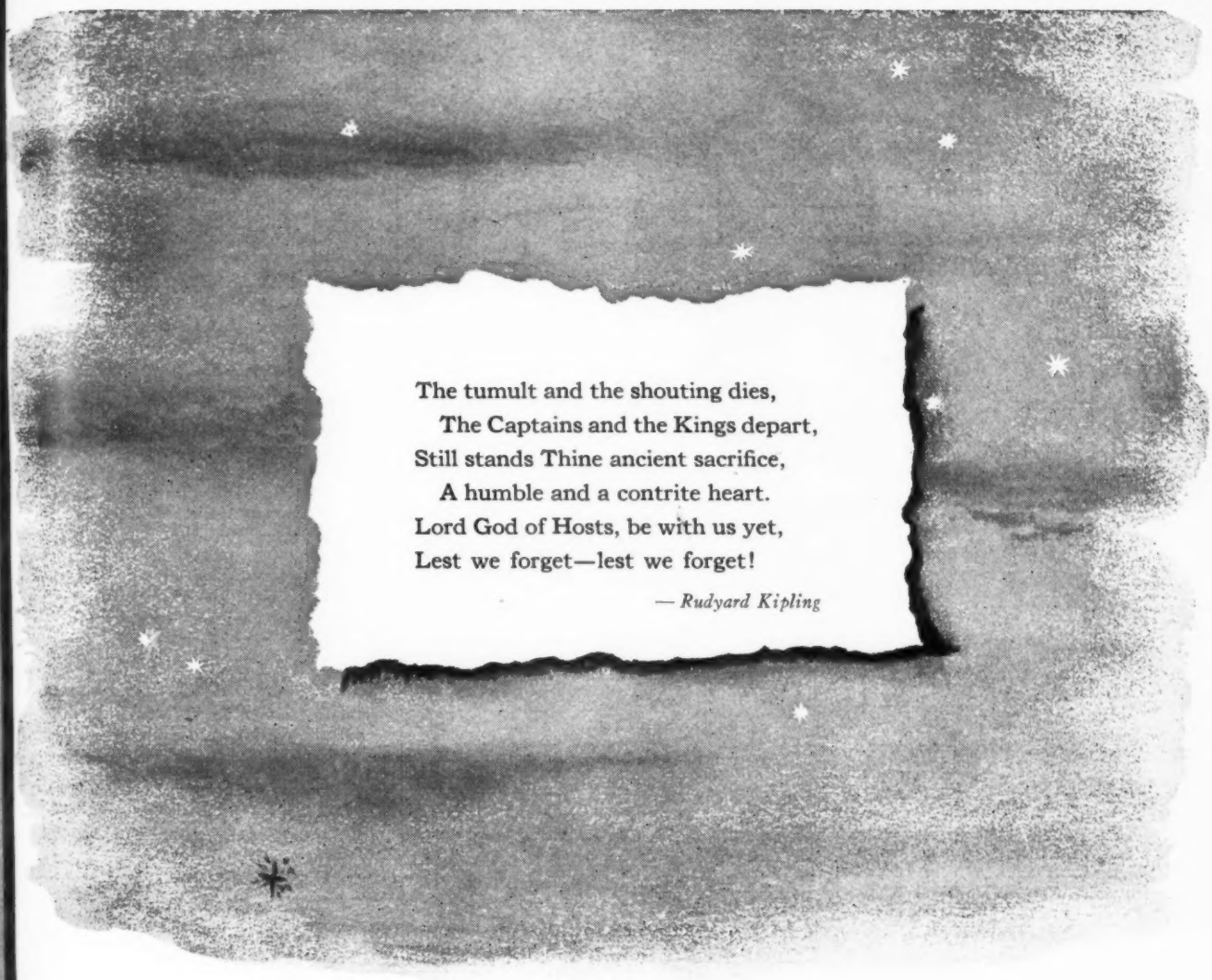
★ LUBRICATION ENGINEERING


The tumult and the shouting dies,
The Captains and the Kings depart,
Still stands Thine ancient sacrifice,
A humble and a contrite heart.
Lord God of Hosts, be with us yet,
Lest we forget—lest we forget!
— Rudyard Kipling

To Our Customers and Friends—

You and we have worked together through four of the world's most tragic years. Our common interest in a common cause has strengthened old business friendships and has made many new ones. For this we are grateful.

This experience of mutual respect and confidence is *one* result of the war that will be carried over to the problems of peace. It is the very stuff that will assure profitable business at home and better relations with our neighbors abroad.

We of the Biddle Company fortunately have no factory problem of reconversion. For the most part, we make the same testing instruments for industry at peace as were required for war. And as more of our products become available for industrial and rehabilitation purposes, we will continue to serve you—in good faith always—and to the best of our ability.

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High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

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A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

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High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

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Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal

Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

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Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

New Equipment

(*Continued from page* 126)

obtainable in 2- 3- and 6-in. dial sizes. It is installed easily by connecting ½-in. standard connection nut directly into point of service or into separable socket or other mounting accessory. Separable high-pressure sockets are designed for universal service conditions, having 1- or ¾-in. standard connections. **Equipoise Controls, 342 Madison Ave, New York 17, N. Y.**

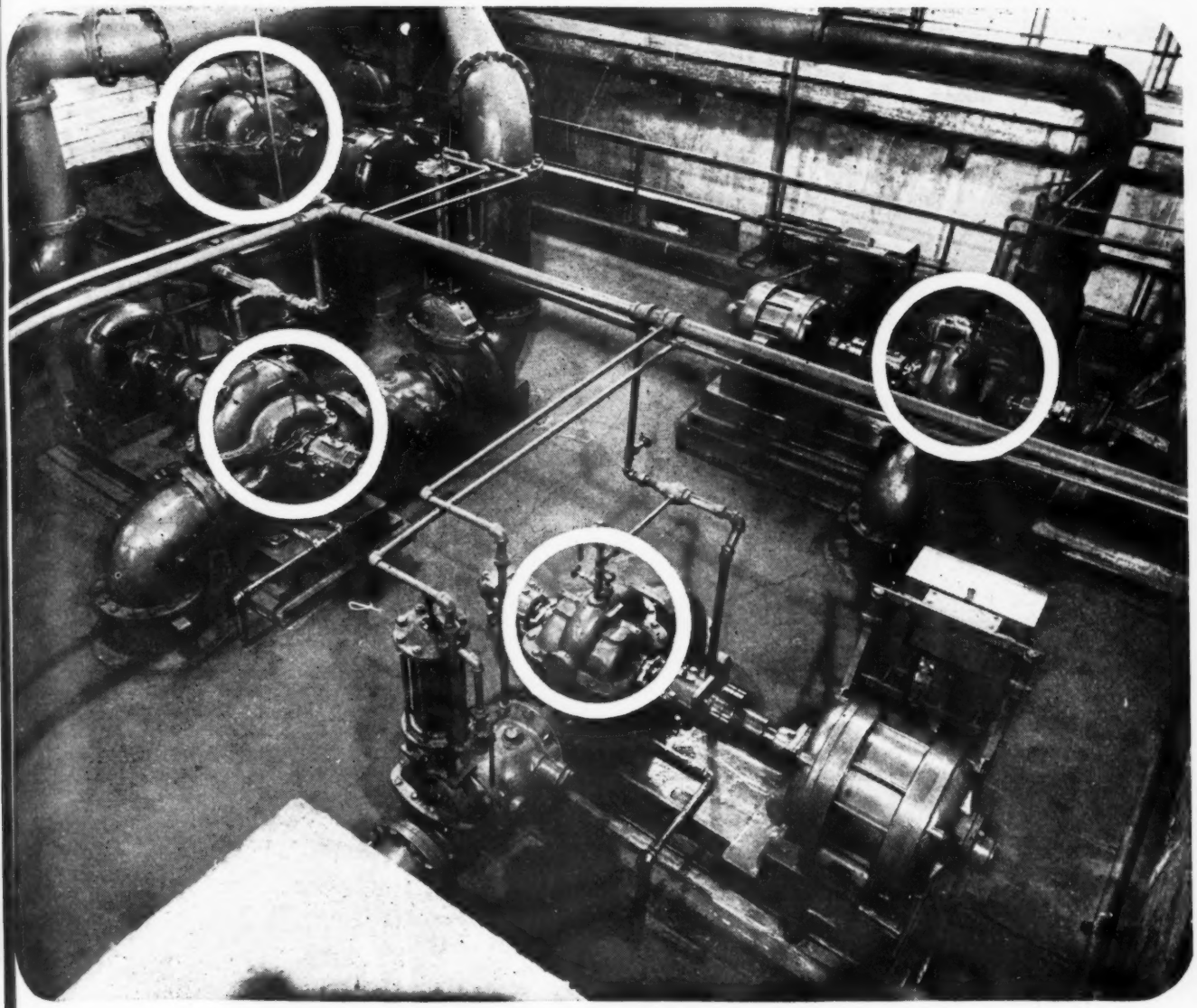
Infra-Red Units

TWO PORTABLE electric infra-red units are for reflector (R40 and RE40) infra-red or drying lamps. Model W6 is designed for six lamps and Model R12 for twelve lamps. Reflector lamps in any size (125, 250, 375 watt) may be used. Units may be employed where heat is desired in baking, drying, evaporating, preheating, etc. Units are ideal for smaller industrial plants, repair shops, etc. Carbomatic portable units are made of heavy-gage metal, rigidly constructed, with complete flexibility for adaptation at any angle or in any position. **Carbomatic Corp, 117 W 63rd St, New York 23, N. Y.**

Metalizing Gun

SCREENING EXHAUST OPENINGS with a fine-mesh screen protects working parts of *Mogul* Model F metalizing gun against dirt and foreign matter getting into turbine housing when gun is not in operation. Gun can be assembled or disassembled without special tools. Model F is equipped with an improved turbine for increased power and is perfectly balanced for smooth, stable operation.

Operation is not interrupted in changing speed, this being accomplished by an easy-to-reach fingertip speed control built into design. Specially designed taper valve permits ¾ range for lighting the gun. In one operation, air, gas and oxygen are turned on in their proper sequence and proportion, thus reducing gas fumes to a minimum and eliminating all possibility of oxidation o



LARGE WOOLEN MANUFACTURER

Relies on Warren Pumps in its Filter Plant...

Shown above is part of one of the largest rapid sand filter installations in New England. It was installed by Hungerford & Terry, Inc., in a well-known woolen manufacturing plant.

The company operates more than 750 looms at this mill, and Warren pumps are relied upon to handle between 42 and 82 million gallons of water per week.

Write for complete information on Warren Pumps for textile and other mill installations.

ARMY E NAVY

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

Paste THIS in your handbook, Mr. Engineer!

IF your pressure line requires a SPECIAL Relief or Safety Valve—Farris engineers can provide the proper valve, or custom build one for you!

FARRIS Handwheel Relief Valve No. 1450, for frequent changes of relief pressures. Special construction to withstand excessive wear of continual adjustment. Sizes ½" to 8"

FARRIS Safety Relief Valve No. 2175. Full nozzle port, hi-lift. Steam Separator Bell. Pressures to 600 lbs. at 750° F. Sizes ¾" to 6".

FARRIS engineers have been called in on so many special valve jobs that we often wonder "WHAT NEXT!" Minor pressure technicalities and major valve engineering projects alike — we have built accurate, dependable safety and relief valves for *all* of them. Of course we're proud of that record—we are only human!

And as we designed and built those special FARRIS valves for new industries, new processes, new products . . . we added most of them to our regular line of valves. So today, it's a good bet that among the FARRIS collection of all types, sizes, and metals, there is *the very valve* which will exactly meet your requirements.

But if WE have *any* doubt about that, we will *custom build a valve especially for your job.* And we'll be glad to do it, because we may find that we can add your new FARRIS valve to our already extensive line . . . so we'll mutually benefit from your problem!

Now, don't you agree . . . that makes good business sense? *Why not write today for our Specifications Bulletin?*

FARRIS ENGINEERING COMPANY
366 Commercial Avenue, Palisades Park, N. J.

Write us today about any Safety or Relief Valve Problem confronting you. If you are lucky and do not have a valve headache now, GOOD! But paste this ad in your handbook for future emergencies.

Farris
SAFETY and RELIEF VALVES

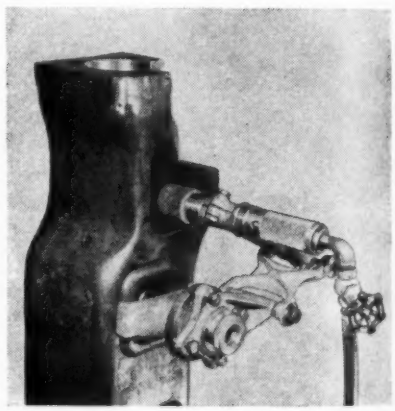
metal. Model F gun has low gas consumption. Any combustible gas, such as acetylene, propane, butane, coal gas or natural gas can be used.

Model FH Mogul metalizing gun is for hand-operated work, such as spraying surface areas where soft metals are used for corrosion protection. Difference between this model and Model F is that the air, gas and oxygen hoses are in front instead of at side of gun. Model F is equipped with tool-post mounting. Pistol grip is available for this model also. **Metallizing Co of America, 1330 W Congress St, Chicago 7, Ill.**

Transformer Welder

NEW 200-AMP WILSON BUMBLEBEE transformer welder, an ac machine of medium capacity, has built-in capacitors which, according to maker, make possible power economies up to 35%. Unit is also equipped with a disconnect switch.

Self-contained, the welder has two ranges of current, the low from 30 to 110 amp and the high from 90 to 275 amp. Continuous stepless current control is provided throughout each current range by simply turning the crank on top of machine. Full-view scale makes current settings easy to read. All windings are covered with spun-glass fiber, heat-resistant Class B noninflammable insulation. **Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**



Gasket Seat Grinder

NEW HANDHOLE SEAT GRINDER provides an easy, fast and accurate way of refacing handholes of all sizes and shapes through a grinding wheel properly aligned with gasket seat by four screws in an adjusting plate. These assure grinding in plane of gasket seat only. In addition to grinding wheel, which is mounted on a ball-bearing spindle, assembly consists of a clevis arm, adjusting plate and a face plate screwed onto a handhole-plate stud near hole to be refaced. Amount of grinding is accurately controlled by a finely threaded feed screw. Grinding wheels are double faced for longer service.

Clevis arm provides for free movement of spindle around handhole. A high-speed compressed-air motor, such as is used for operating Elliott's 2-in. tube cleaners, drives the grinder.

Complete outfit includes two grinding wheels, three guide rollers for grinding

HOODOO SMASHERS!

America's newest and widest line of V-Belts—Allis-Chalmers' Texrope —. solves problems that have hoodooed drives in almost every industry . . . see what they can do for you!

I ROUT THAT OLD BUGABOO, STATIC ELECTRICITY. I'M STATIC-RESISTING SUPER-Z. MY BUILT-IN CONDUCTING ELEMENT CARRIES CHARGES TO THE MACHINE WHERE THEY'RE GROUNDED.

Texrope V-belts are available nation-wide through Allis-Chalmers Dealers and Sales Offices

IT PAYS TO MAKE

ALLIS-CHALMERS

YOUR V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by A-C.

BULLETIN!

SPEED RECONVERSION WITH HELP OF NEW FREE A-C KIT!

Guide to "How to Take Reconversion Inventory" of Drives, Motors, Pumps

Help in the big job of reconverting for peacetime production is now offered to plants everywhere by Allis-Chalmers Mfg. Co., its district offices and distributors. To all who request it, we're sending the new "Reconversion Inventory Kit", planned to speed the task of determining the condition of your existing equipment — V-belt drives, motors, and centrifugal pumps — which will be used in reconverted production.

SUGGESTS PROCEDURE, STATES STANDARDS

Used by foremen, maintenance men, and engineers, the Kit is a real time-saver . . . leads efficiently to probable trouble spots, helps clear them up. Gives bearing tolerances, resistance formulae, etc., in compact, easily-used form. Check List appraisal charts help determine present and future condition of units inventoried.

HOW TO GET YOUR KIT

For your free Reconversion Inventory Kit, call your nearest Allis-Chalmers distributor or district office, or write Dept. 16, ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis.

A-1910

ALLIS-CHALMERS MFG. CO.
Dept. 16, Milwaukee 1, Wis.

Please send Reconversion Inventory Kit free of charge to:

Company.....

Address.....

.....

Attn. of Mr.....

No Idle Home Equipment When Repair Parts Come by AIR EXPRESS

Empty spaces on retailers' shelves or shortages of repair parts do not always mean that merchandise is not to be had. Often it's merely a matter of ordering a little at a time.

This is where Air Express steps in. It speeds merchandise to those shelves—even if in small amounts — so that customers do not have to be turned away or told that their household equipment cannot be repaired for weeks. It brings the spare parts stocks of the nation within but a few hours of retail stores. Very often, Air Express means next day delivery.

And not only does the speed of Air Express meet emergency needs in the retail trade, it puts suppliers' stocks so near at hand that it often means greatly reduced inventory and, therefore, faster rate of turnover.

Specify Air Express-a Good Business Buy

Shipments travel at a speed of three miles a minute between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Rapid air-rail service to 23,000 off-airline points in the U. S. Service direct by air to and from scores of foreign countries.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST

Write Today for interesting "Map of Postwar Town" picturing advantages of Air Express to community, business and industry. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Express office.

Phone AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY
Representing the AIRLINES of the United States

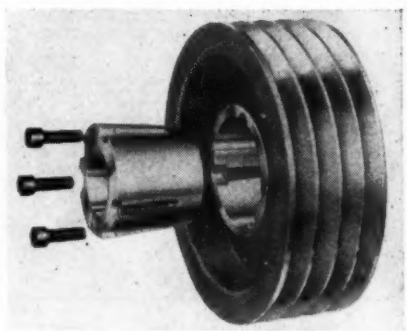
gasket seats of different widths, wire brush, stud adapters, plastic-mounted viewing mirror, wrench, air hose and motor lubricator. **Lagonda Div, Elliott Co, Springfield, Ohio.**

Chlorine Comparators

COMPLETE LINE of LaMotte chlorine control units has been made available, paralleling the recent advances in the more effective chlorination procedures. A new series of standards has been prepared of a size interchangeable with regular LaMotte pH color standards. An additional development is the ortho tolidine-arsenite test, which makes it possible to measure chloramine and active chlorine separately. Also, it is possible to estimate the error that is caused by other interfering substances. **LaMotte Chemical Products Co, Towson, Baltimore, Md.**

Electrical Connectors

HYDENT ELECTRICAL CONNECTORS for small-sized aluminum wires and cables are said to provide permanent, low-resistance connections. In manufacture of these connectors, zinc is plated on oxide-free aluminum. Barrel of each connector is then filled with petrolatum jelly in which zinc dust is suspended. Thus, when cable end is inserted into zinc-filled barrel, zinc compound is forced in between the individual strands. Then as connector is indented to cable with Burndy *Hytool*, zinc particles tend to break through oxide film on each strand as the wires are forced to rearrange themselves and wipe against one another under pressure of indenting tool. **Burndy Engrg Co, 107 Bruckner Blvd, New York 54, New York.**

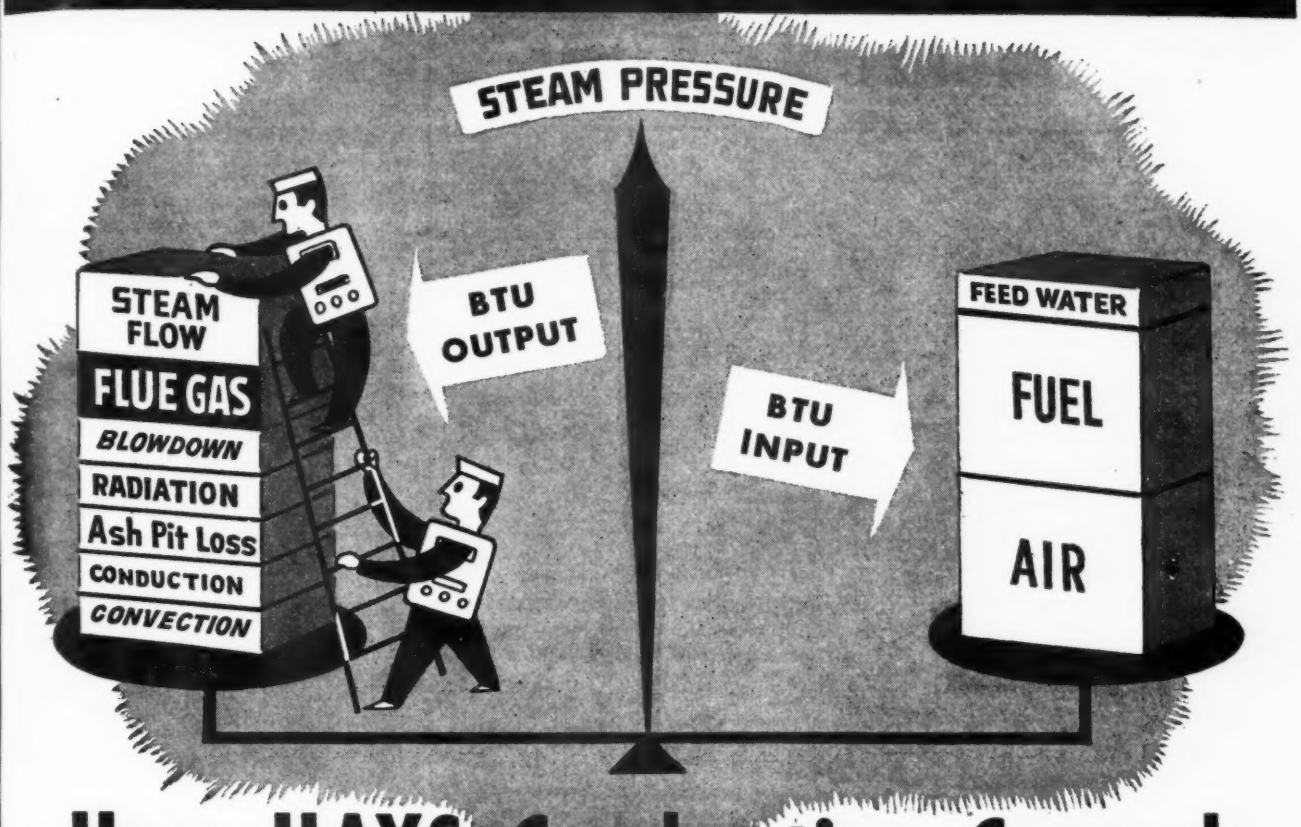


V-Belt Sheave

TO INSTALL the Taperlock sheave, it is only necessary to slip sheave and bushing assembly onto the shaft and tighten two or three locking screws, depending upon size of sheave. The screws are in threaded engagement with the sheave hub and are free in the bushing groove. As screws are tightened, they push against tapered bushing, forcing it into tapered bored hub. This causes bushing to contract and wedge between hub and shaft on which it is installed.

To take sheave from shaft, locking screws are removed and one or two of them are inserted in jack screw holes, which are partly in bushing and partly in hub. Por-

ELECTRICAL OPERATION IS AS MODERN AS POST WAR INDUSTRY MUST BE!



How HAYS Combustion Control balances heat in-put and out-put

...You SEE the 12 Vital Points of Modern Combustion Control in Hays Sales Visual

The most comprehensive, most understandable explanation of automatic combustion control ever compiled. Ask the Hays representative to show it to you.

1. The purpose of Combustion Control.
2. How that Purpose is accomplished—3 methods of control.
3. What results can be expected of each.
4. Elements of a *good* control system.
5. Elements of a good controller
6. *Coordinating* the controllers.
7. Selecting the best system for your needs.
8. How Automatic Combustion Control operates.
9. How each individual controller operates.
10. How controllers are calibrated and adjusted to fit requirements.
11. How controllers are stabilized to prevent hunting or over-travel.
12. Typical installations of Automatic Combustion Control.

HERE IS METERING CONTROL reduced to its simplest, most effective terms:

- A master steam pressure controller responds to changes in steam pressure and adjusts air and fuel controllers
- Air and fuel feed controllers, operated by accurate impulses from the master controller, supply the correct amount of air and fuel to maintain the steam pressure constant
- A furnace draft controller operates to hold furnace draft constant

These control units measure every slight variation in every combustion factor—and instantly adjust them ***in a precisely coordinated pattern.*** Impulses to all actuating devices are instantaneous—***because they are electrical.***

There you have it.

How that system will benefit your business—by vital savings in man-hours and steam costs—can easily be learned by consulting with Hays engineers. As a practical first step, arrange to see the Hays Visual Explanation of Automatic Combustion Control—worth seeing. Write us about it.

The HAYS CORPORATION
SINCE 1907 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

How To Give Stuffing Boxes
THE "BELMONT CURE"

FIRST STEP is to check pumps and engines for signs of leaking valves, pistons, rods and plungers.

THIRD STEP is to have a supply of standard Belmont Packings on hand so as to stop the leak at once with a packing that will do the job best and for the longest time.

SECOND STEP is to refer to Belmont PACKING RECOMMENDATION CHARTS which quickly identify the right packing type for each set of operating conditions.

BELMONT DISTRIBUTORS are located in every large industrial center, ready to serve you promptly from local stocks. Get the PACKING RECOMMENDATION CHARTS from the one nearest you — or send the coupon to us.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

on the blue-and-orange box

THE BELMONT PACKING AND RUBBER COMPANY
Butler & Sepviva Streets, Philadelphia 37, Pa.

Gentlemen: Please send PACKING RECOMMENDATION CHARTS for the services checked:

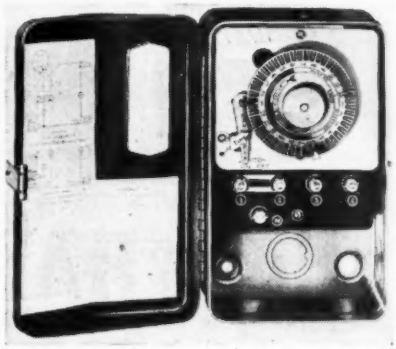
☐Steam . . . ☐Hot Water . . . ☐Cold Water . . . ☐Brine . . . ☐Ammonia . . .
☐ Acids & Caustics . . . ☐ Air . . . ☐ Gas . . . ☐ Oil . . . ☐ Gasoline . . .
☐ Asphaltic & Tar Products . . .

Name. . . . . .
Company. . . . . .
Address. . . . . .

tion of the jack screw hole in the bushing is threaded and that in the hub portion unthreaded. As screws are tightened, bushing is dewedged and sheave is free for removal from shaft. **Dodge Mfg Corp, Mishawaka, Ind.**

Gasket Material

IT IS NO LONGER NECESSARY to stock gaskets in an assortment of sizes or to cut gaskets from a sheet. A new gasket material, called *Plastic-Gasket*, can be applied to surfaces of flanges, etc, about $\frac{1}{8}$ in. thick, with knife or fingers. *Plastic-Gasket* may be applied over ordinary gaskets to increase their effectiveness and preserve them so they can be reused. It is claimed that *Plastic-Gasket* prevents leakage, oxidation and corrosion. It will not dry out, burn out or blow out and is unaffected by temperature and pressure. Six lb of *Plastic-Gasket* covers about 6000 sq in., $\frac{1}{8}$ in. thick. **Flexrock Co, 3677 Filbert St, Philadelphia 4, Pa.**



Time Switches

LATEST IMPROVEMENT in Paragon 300 Series time switches is the *Telechron* motor. Operating advantages claimed for this motor are: complete self-oiling lubrication by patented capillary oiling system, practically instantaneous self-starting at full-rated load, gear reduction fully sealed to exclude dust and dirt, low power consumption. The 300 Series is light in weight, small and compact in design, has switch capacity of 3000 watts per pole with easily mounted accessible terminals, skip-trip feature, knockouts on both sides, back and bottom, and 2-bearing plate construction. These switches are for controlling stokers, oil burners, blowers, pumps, valves, motors, signs, commercial lights, attic fans, etc. **Paragon Electric Co, 37 W Van Buren St, Chicago 5, Illinois.**

Lightning Arresters

PELLET LIGHTNING ARRESTERS for protection of apparatus on distribution circuits, 15,000 v and below, have a separately sealed, nitrogen-filled gap chamber. The dry nitrogen prevents formation of ozone or oxides, keeps gap electrodes bright and gives more stable gap-sparkover characteristics.

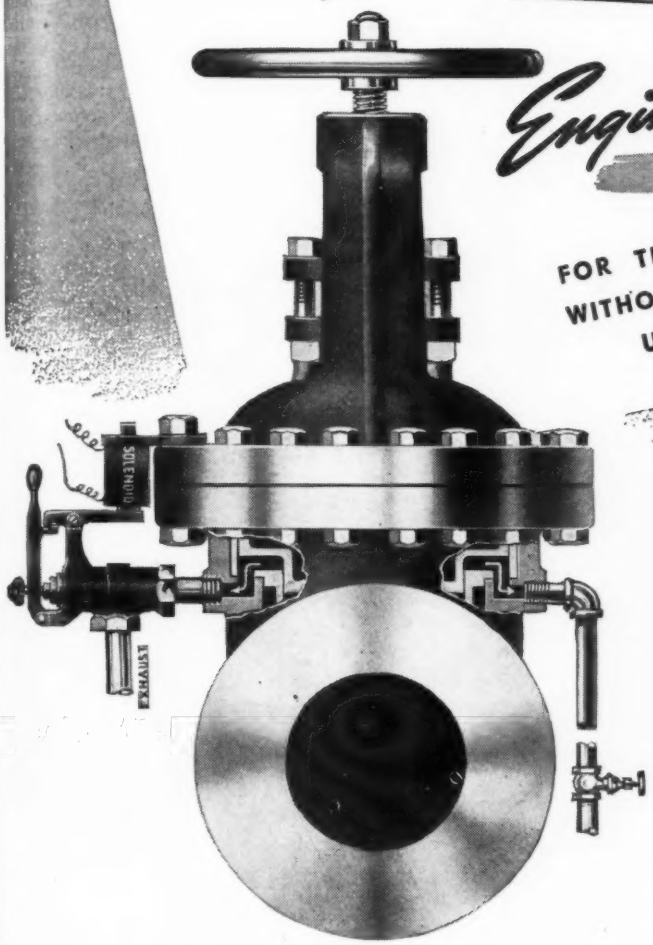
To eliminate recognized adverse effects of internal condensation caused by changes in outdoor temperature, all air and atmospheric moisture are completely evacu-

INSTANT! UNFAILING!

AUTOMATIC!

Engineered Protection

FOR THE MOST EXACTING INSTALLATION
WITHOUT BANGING, CHATTER OR SPINNING
UNDER ANY FLOW CONDITIONS



GOLDEN-ANDERSON

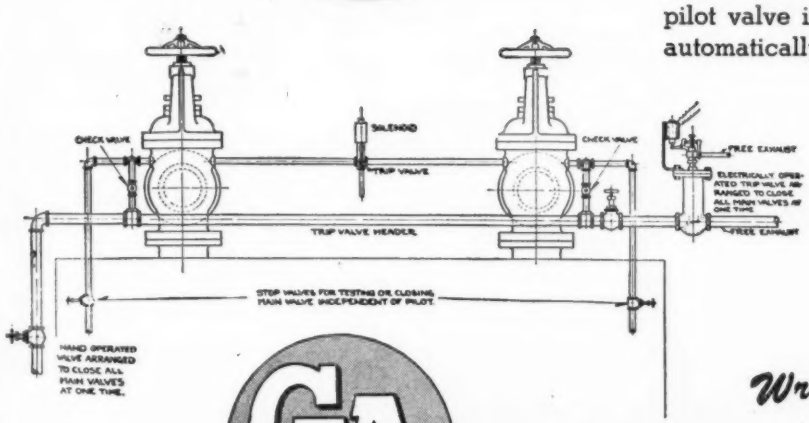
Electric

EMERGENCY TRIP

VALVES

With the AC or DC Solenoid Trip Pilot Valve reset in its closed position, the valve will automatically open as the handwheel stem is run up. When the trip pilot valve is opened, the main valve will instantly, automatically close and remain closed until the trip pilot valve is manually reset. Main valve may be closed at any time with the handwheel.

Write for descriptive technical catalog listing more than 1500 sizes and types of engineered Golden-Anderson Valves.


CHECK VALVE
SOLENOID
TRIP VALVE
CHECK VALVE
FREE EXHAUST
ELECTRICALLY OPERATED TRIP VALVE ARRANGED TO CLOSE ALL MAIN VALVES AT ONE TIME
TRIP VALVE HEADER
FREE EXHAUST
STOP VALVES FOR TESTING OR CLOSING MAIN VALVE INDEPENDENT OF PILOT
HAND OPERATED VALVE ARRANGED TO CLOSE ALL MAIN VALVES AT ONE TIME.

Arrangement of Valves with individual solenoid pilot control, as well as for simultaneous closing by master solenoid pilot valve with valve header unit.

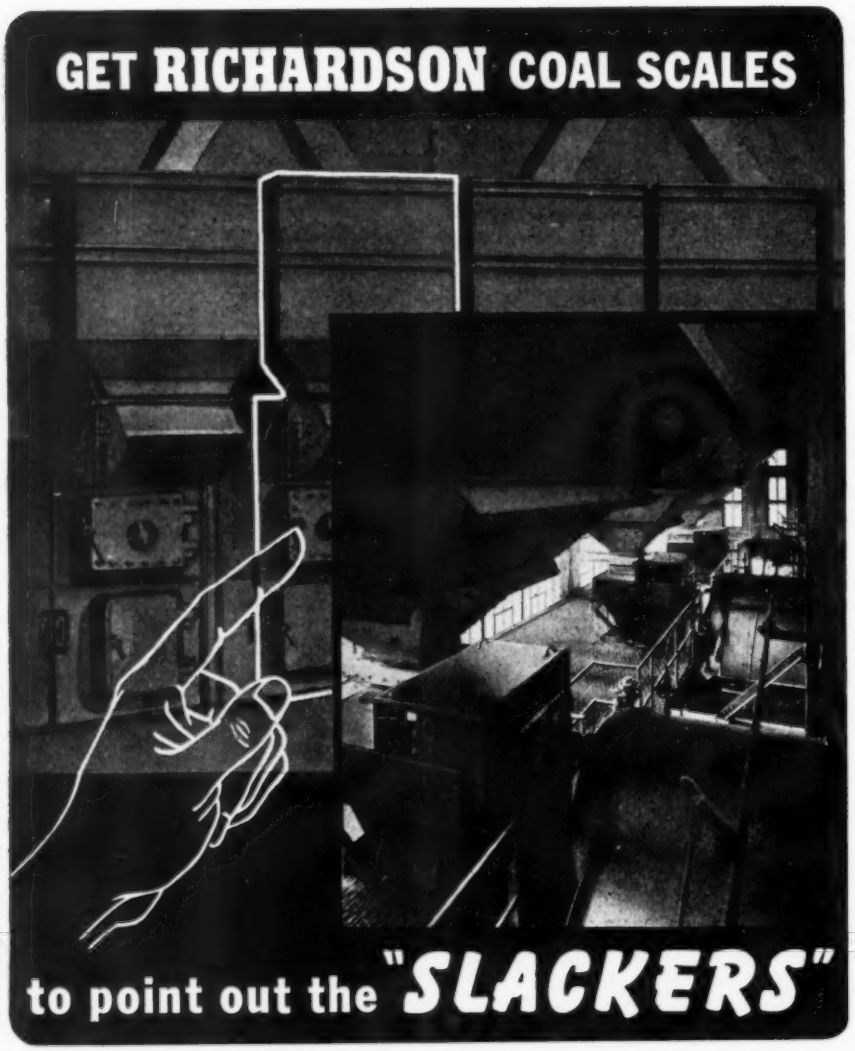
Write for descriptive technical catalog!

GA

GOLDEN-ANDERSON

VALVE **Specialty Company**

FULTON BUILDING • PITTSBURGH 22, PA.



Here's a way to check for—and keep getting—maximum efficiency from new or revamped boilers and turbines . . . a way that helps you get every B.t.u. and kw.-hr. of which they are capable:

Spot possible losses, *right at the source* . . . with a Richardson Coal Weighing, Conveying and Feeding System that weighs and records every pound of coal burned, so that boiler performance—evaporation rates—and similar factors—are definitely known.

The heart of the Richardson System that gives you indisputable records is the Automatic Coal Scale. It puts the finger on the "slacker" boiler because if any boiler in a battery is burning more coal than its mates, under the same conditions, it's pretty certain something is wrong with that boiler. Richardson Scales automatically weigh and register the coal consumed per hour, per shift, perday—or week.

In addition to the weighing unit, a Richardson System includes gates and spouts for conveying coal from the overhead bunkers to stokers or pulverizers. The MONORATE Non-Segregating Spreader assures even distribution across the stoker hopper without segregation of coarse or fine coal.

Bulletin 1143 may prove that the Richardson System can save you coal —the largest single item in cost of steam production. Write today for a copy.

348

RICHARDSON SCALE CO.
CLIFTON, N. J.
Atlanta • Boston • Chicago • Omaha • Montreal • New York • Philadelphia
Minneapolis • Detroit • San Francisco • Toronto • Wichita • Pittsburgh

ated from gap chamber. This process not only excludes moisture of normal atmospheric humidity from the series gaps of the arrester, but provides an errorproof vacuum-withstand test of the main sealing of each arrester.

After completely evacuating gap chamber, dry nitrogen is injected through a small treating hole in metal cap, which is then immediately solder sealed. Excluding all oxygen, which is the essential agent for ozone and all forms of oxidation, the injected dry nitrogen is thus permanently sealed in gap chamber. **General Electric Co, Schenectady 5, N. Y.**

Cable Connectors

THE MAKING OF CONNECTIONS, taps and splices in coaxial and shielded cable is greatly simplified by connectors designed especially for the purpose. These connectors are new members of *Hydent* line, which are installed by indenting with Burndy *Hytools*. Solder and possibility of insulation damage by heat are eliminated. **Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y.**

Fire Extinguishers

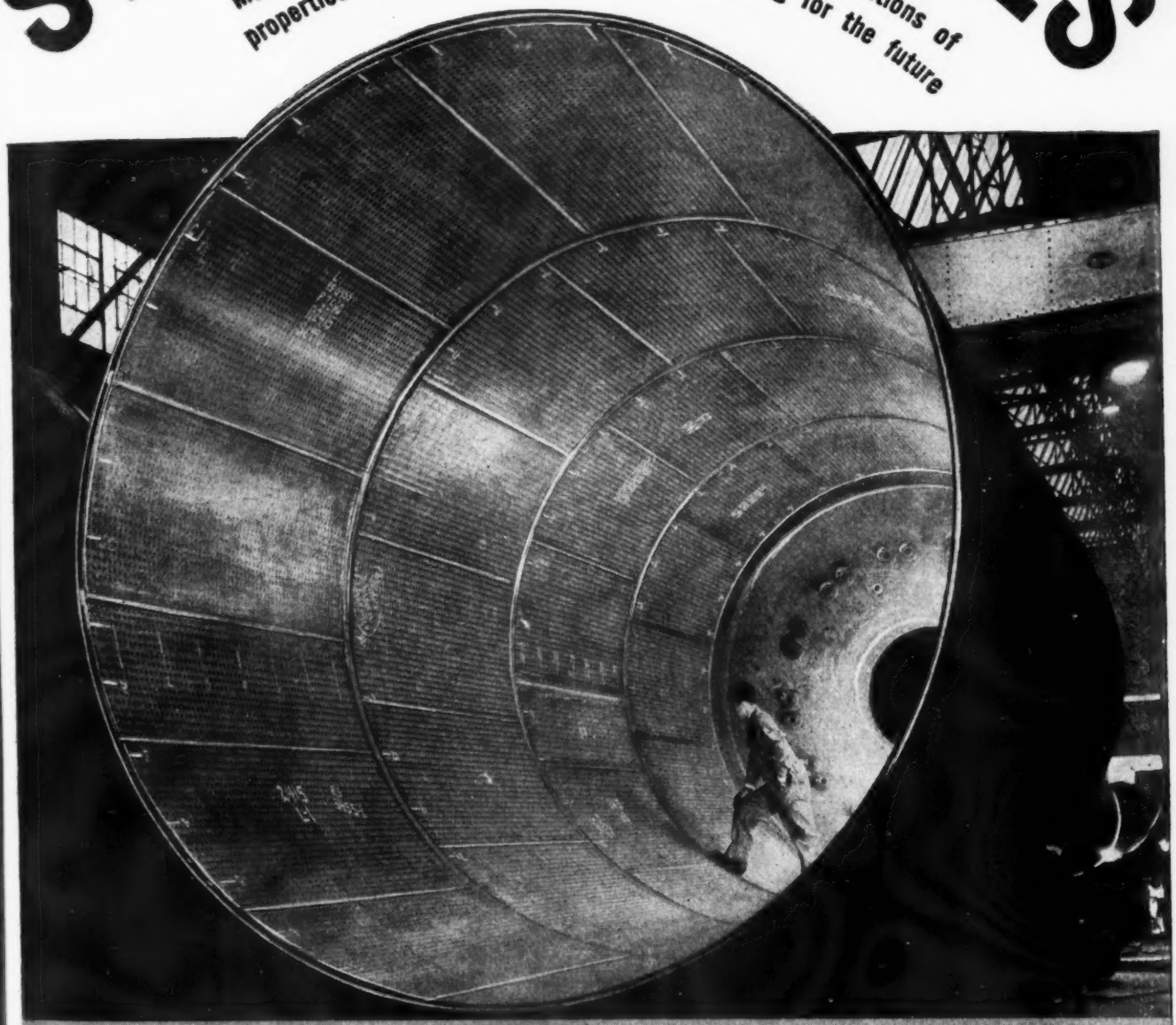
FOAMITE CHALLENGER 40-gal engine extinguishes hot-oil fires without danger of reflash. Manufacturer claims it produces 50% more fire-killing foam. It is said to deliver over 450 gal of foam in less than 3 min. Outstanding feature is a metering device, which is an important factor in extinguisher's foam-making function. **American-LaFrance-Foamite Corp., Elmira, New York.**

Hose Coupling

BUILT TO WITHSTAND a pressure of 600 psi, Wiggins industrial hose coupling brings full water pressure right to nozzle end. The 2-part aluminum unit includes a threaded-end section that applies on a standard threaded faucet and a ring-equipped section for application in the end of a length of hose. Ring is pulled back by a spring and moves axially over a set of hinged dogs. It is knurled to provide an

STAINLESS STEELS

Most versatile of modern metals... their unique combinations of properties merit your consideration in designing for the future



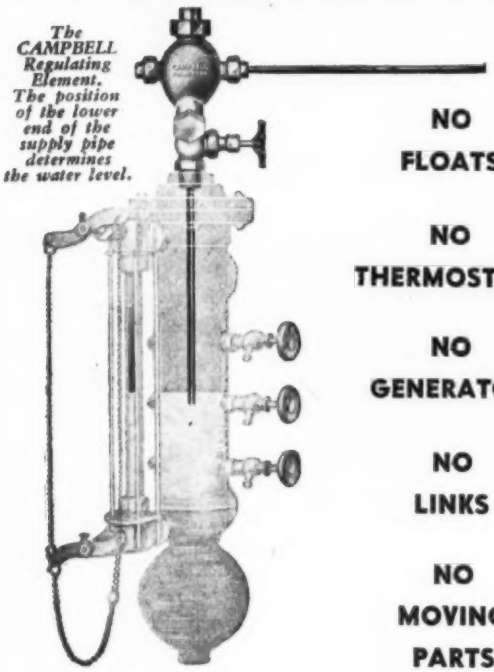
The commonly used chromium-Nickel type stainless steel that lines this fractionating column possesses natural immunity to rust and corrosion under virtually all oxidizing-acid conditions. Its resistance to creep, scale or oxidation at high temperatures assures long economical operation. Built by A. O. Smith Corporation, Milwaukee, this column, including the top section, exceeds 125′ in length.

* * *

International Nickel are miners, smelters and refiners of Nickel, an important ingredient of the stainless steels, but do not produce stainless steels. If interested, please communicate with established sources of supply for stainless steels.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

CAMPBELL
Boiler Feed Water Regulator



The CAMPBELL Regulating Element. The position of the lower end of the supply pipe determines the water level.

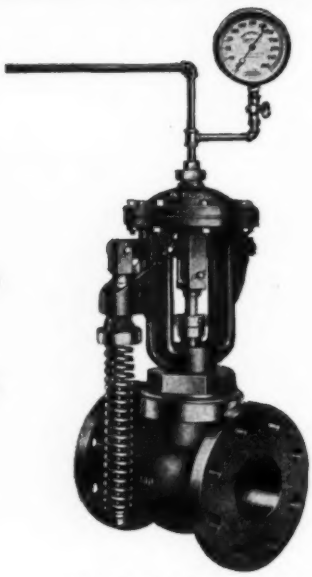
NO FLOATS

NO THERMOSTATS

NO GENERATORS

NO LINKS

NO MOVING PARTS



The ATLAS Control Valve It may be placed at any distance from the regulating element. Controls large water lines as easily as small. No pressure limit. No capacity limit. No sticking. Dirt and scale make no difference.

The Campbell saves labor, saves fuel, eliminates trouble, and insures proper water level in any boiler, regardless of size.

We can't tell all about the CAMPBELL in this space, so, ask for complete data. For instance, we have a pamphlet which gives *"17 Reasons Why the CAMPBELL Is Preferred by Boiler Operating Engineers."* Reason No. 16 is: "The money saved by the use of the CAMPBELL in the course of a year is usually much more than enough to pay the first cost of the entire installation." 16 other reasons are given in the pamphlet. Ask for it.

In addition there are other ATLAS products, listed below. Check those items on which you want data and mail to us with your name and firm address.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

Specialists in Regulation for Nearly a Half Century

289 South St., Newark 5, N. J.

Representatives in Principal Cities

☐ Please send complete information on the CAMPBELL Boiler Feed Water Regulator. Also please send information on the following Atlas products—

☐ Damper Regulators
☐ Temperature Regulators
☐ Reducing Valves
☐ Exhaust Control Systems
☐ Pressure Regulators
☐ Pump Governors
☐ Float Valves
☐ Oil Control Cocks
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves

operating grip. Moving ring back against spring permits dogs to swing open and clear a holding ring integral on shank of section applying on the faucet. Releasing ring after two coupling sections have been brought together closes dogs inward to grip ring and hold assembly together. Shank on faucet section rides inside a rubber gasket in ring section to prevent leakage at normal hose pressure.

Coupling is made in two sizes: ¾ and ¼ in. standard. **E B Wiggins Oil Tool Co, 3424 E Olympic Blvd, Los Angeles 23, Calif.**

Nozzle Tester

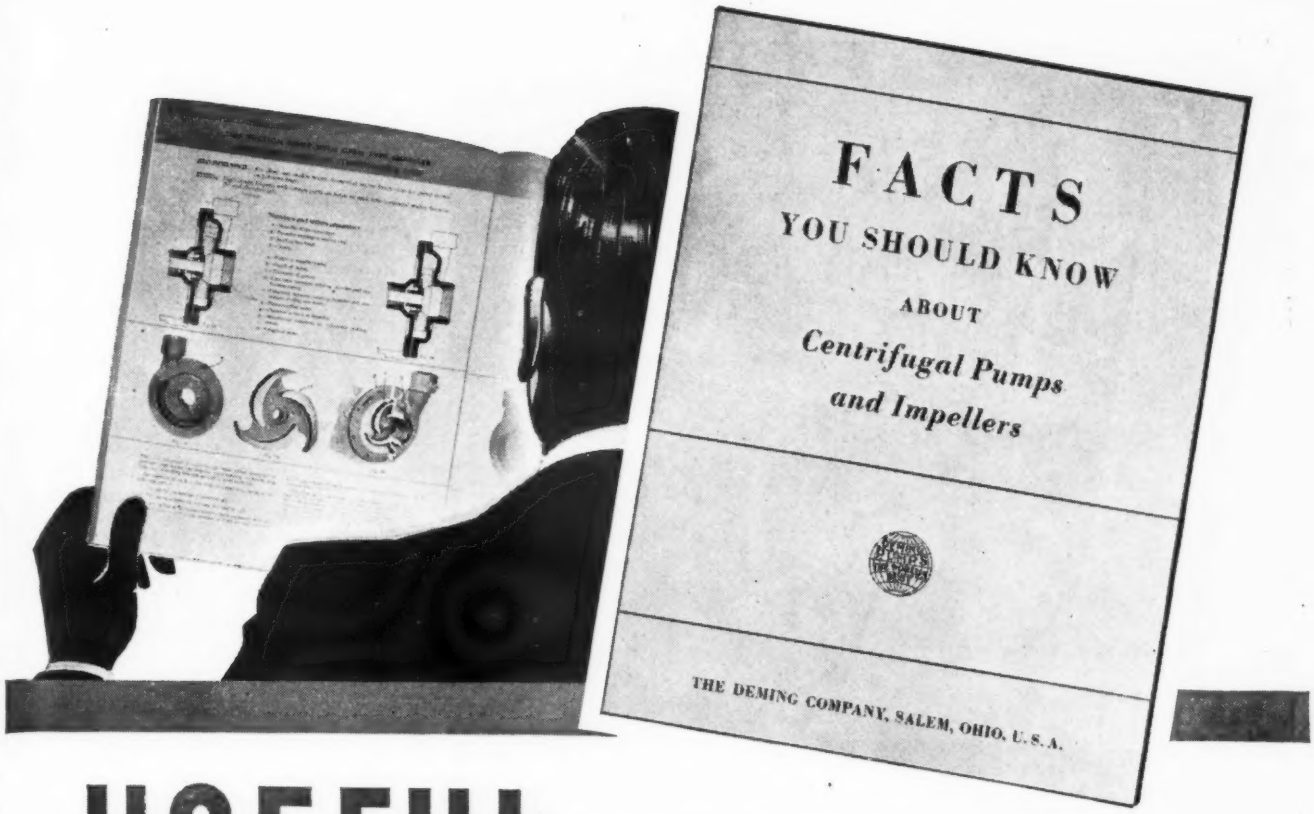
UNIVERSAL DIESEL nozzle and injector tester is a portable unit for all popular makes of diesel engines. Any mechanic or diesel-engine operator can measure injector opening pressures with it, determine accurate adjustment, check spray pattern for uniformity and detect other irregularities, such as sticking needle valves, dribble and leakage around valve seats.

Buda *Universal* diesel nozzle tester has a standard hydraulic pressure gage, 3½ in. dial, 3000-psi capacity and 100-psi gradations. Gages of 5000 and 7500 capacity are available also. Tester weighs less than 19½ lb. including all-steel carrying case, one adaptor and removable 12-in. steel handle. Carrying case holds such extras as adaptor fittings, special cradle and "popping" device, extra pressure gages, risers, spray pan, high-pressure lines, fittings, etc. **Buda Co, Harvey, Ill.**

Rust Inhibitors

CARBO "C" INHIBITOR AND CARBO "N" inhibitor meet need for temporary rust prevention on metal materials during inside storage. *Carbo* "C" inhibitor, the more universal of the two, is inactive on all metals and alloys, including magnesium and aluminum. *Carbo* "N" inhibitor has no effect on iron, steel or ferrous alloys, although it does have a slight action on softer metals, such as lead, zinc, magnesium and aluminum.

Carbo "C" and *Carbo* "N" inhibitors also prevent rust in lines that drain salt solutions from crude-oil storage tanks and from bottoms of tanks where water and brine



USEFUL INFORMATION

ON STANDARD CENTRIFUGAL PUMPS

Here, in this graphically illustrated, 20-page article is *useful* information relating to all types of general purpose Centrifugal Pumps and the various types of Impellers. All information is basic and unbiased with the objective of assisting users of Centrifugal Pumps to a clearer understanding of principles of design, construction and operation of the various types.

SEND FOR COPY

THE DEMING COMPANY • SALEM, OHIO

Please send us a free copy of the article "FACTS YOU SHOULD KNOW ABOUT CENTRIFUGAL PUMPS AND IMPELLERS."

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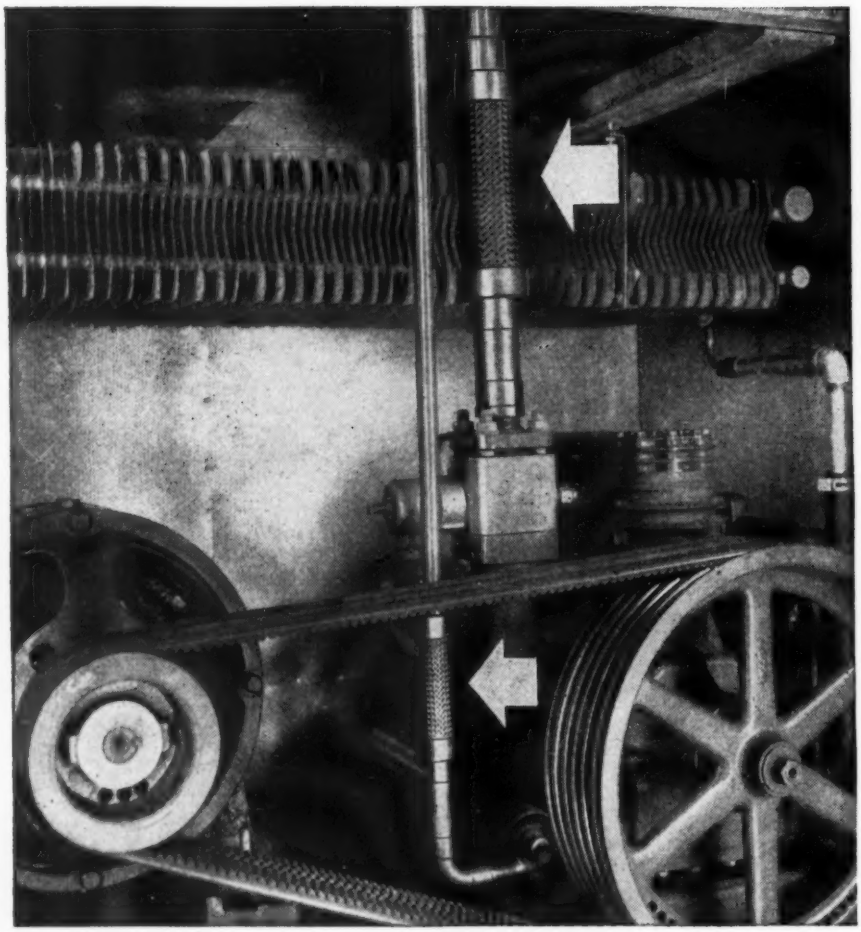


REX *Vibra-Sorbers*
Reduce Vibration Hazards

REX VIBRA-SORBERS—properly installed—substantially reduce servicing costs. For **REX VIBRA-SORBERS** have the exceptional strength and flexibility needed to absorb prolonged vibration and thus prevent the transmission of noises throughout the entire piping system.

In addition, **REX VIBRA-SORBERS** are pressure-tested to insure "refrigerant-tightness." This means greater protection against leakage of valuable refrigerants. **REX VIBRA-SORBERS** of copper bearing alloy are normally used for Freon and Menthol. Units of steel alloys are available for ammonia. Thus, effective corrosion resistance is assured in all types of installations.

Let experienced C.M.H. engineers help solve your vibration problems. Write today for full information.

Flexible Metal Hose for Every Industrial Use

CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

solutions are employed in manufacture of ice, where brine corrodes and eats into pipelines and valves quickly. Inhibitors can also serve as a mixture with cutting oils to protect threads from rust. These inhibitors are distributed in concentrated form only. Add 25 to 100 gal of water to each gal of inhibitor. **Carbozite Corp, First National Bank Bldg, Pittsburgh 22, Pennsylvania.**

Diaphragm Cloth

SPECIALLY PROCESSED cotton cloth, designed for diaphragm use, as in fuel pumps, has excellent bursting and tearing strengths. Cloth remains flexible and is said to offer almost instantaneous recovery over a wide range of operating temperatures. Samples for testing will be sent upon request to manufacturer. **Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington 11, N. J.**

Work Light

IN PLACE OF USUAL CORD AND CAP used on other Swivelier *Work-Lites*, this unit comes with Greenfield cable and leads, for direct attachment to outlet box or transformer, thus grounding the entire unit.

Unit is available in a choice of: (1) arms from 12 to 30 in. long (2) four types of shades—cone, bell, parabola or acorn (3) with or without removable glass lens (frosted, clear or daylight). This *Work-Lite* is made with the universally adjustable spring-construction Swivelier socket. Entire arm is also universally adjustable in the base, which is made with same kind of spring construction used in socket. **Swivelier Co, 30 Irving Pl, New York 3, New York.**

Chain Slings

SAFE-T-LIFT automatically equalizing chain slings, made in 4- 7- 14- 25- and 40-ton capacities, are said to have a safety factor of 4½ times the design load. Operation is simple. Block or chain equalizer unit is placed on crane hook and crane operator spots the hook over approximate center of gravity of load. Floormen then attach sling's chain legs to load.

Power to lift load is applied by crane operator and as crane hook rises the sling's chain automatically adjusts itself through the *Safe-T-Lift* equalizing unit. Unit consists of a sturdy steel block and a floating sheave specially constructed to fit the steel-alloy chain. **Hercules Sling Co, Rockford, Ill.**

Instrument Accessories

IMPROVED PORTABILITY of industrial instruments has been made possible. Two assemblies, comprising handles and parts, are furnished unmounted so that purchasers can attach them according to individual requirements. One consists of a cast carrying handle, plus parts, for smaller instruments such as meters and gages. Other comprises two locker carrying handles, with feet and necessary assembly

2-Stage Hot Process Softeners in the Refinery Field

Shown herewith are the sedimentation tanks of a Cochrane Two-Stage Hot Process Softener,* installed in the plant of a refinery designed and erected immediately after Pearl Harbor, for the rapid production of high octane aviation gasolines.

Cochrane patent No. 2,142,515

Water for the boilers is treated with lime and soda ash in a primary sedimentation tank from which it goes to the second stage tank and then to the filters. This installation is just one more of the growing list of Cochrane Two-Stage Softeners in the petroleum industry.

COCHRANE CORPORATION • 3106 N. 17th ST., PHILADELPHIA 32, PA.
A DIVISION OF AMERICAN ENGINEERING COMPANY

COCHRANE

SOFTENERS · DEAERATING SOFTENERS · DEAERATORS · METERS · STEAM SPECIALTIES

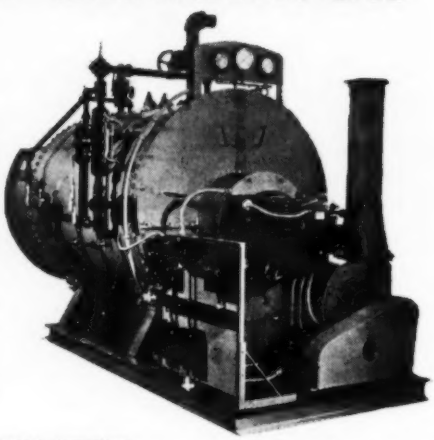
YES! you can have HIGHER

STEAM PLANT EFFICIENCY
with the big benefits of pull-through draft

1. Overall efficiency stepped up to guaranteed 80% minimum
2. No stack or chimney required
3. Eliminates the danger of forcing the products of combustion into the boiler room
4. Long life of the refractories
5. 100% automatic operation . . . with Bunker C or No. 6 Oil
6. Unit construction . . . little floor space . . . easily set up

PREFERRED
UNIT STEAM GENERATOR

Complete with oil burner, induced draft fan, boiler, controls, piping, wiring—ready to set down, hook up and start producing steam power. Perfected under wartime demands by the Pioneer manufacturer of induced-draft steam-generating units. Has met every high production test. Capacities available, 20 to 500 H.P. Send coupon for full data.



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Preferred Utilities Mfg. Corp.,
1860 Broadway, New York 23, N. Y.

PR. 10T

Please send me Bulletin 1000 describing Preferred Unit Steam Generator. Also the booklet of vital facts for executives — DIVIDENDS FROM YOUR POWER PLANT.

Name.....

Address.....

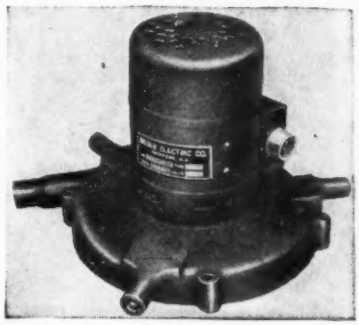
P-10-45

PREFERRED UTILITIES

parts for heavier potentiometer models, including electronic.

Chart drive cutout, embodying means for automatically starting and stopping electronic recorder-chart motion by pen position, will be available for Brown's circular chart *Electronik* recorder. Control contacts are wired in the chart drive circuit. By setting control point chart can be stopped and started as desired, corresponding to any pen position.

Brown *Electronik* contact controller provides safety alarm principles that operate automatically. It also applies on-off control in addition to air control to actuate motorized valves, solenoid valves, contactor panels, signal lights, etc. **Brown Instrument Co, Philadelphia, Pa.**



Lightweight Fan Motor

SIMPLE IN CONSTRUCTION and employing aluminum extensively, lightweight fan motor is for high-capacity blowers. It has sealed bearings, which require negligible servicing. It is designed for 24-v operation on dc, but may be adapted for any specified voltages, and delivers 2 hp. Motor is quiet, self ventilated and operates continually in any position in high-ambient temperatures. Windings are specially designed to match fan characteristics and speeds of 5000 rpm or higher are recommended. By mounting motor directly on blower housing one end shield is entirely eliminated. **Bogue Electric Co, 40 Kentucky Ave, Paterson 3, New Jersey.**

Hole-Cutter Kit

BRUNO KIT No. 790, for cutting holes of various diameters in wood, metal or plastics, is available with straight shanks for pneumatic and portable electric drills and drill presses. It contains one Model No. 100 adjustable hole cutter (with $\frac{1}{4}$-in. shank) for cutting holes $\frac{3}{8}$ to $1\frac{1}{4}$ in. and one Model No. 101 ($\frac{3}{8}$-in. shank) that cuts holes 1 to $2\frac{1}{2}$ in. Tools are equipped with high-speed steel blades having an all-purpose grind. **Bruno Tools, Beverly Hills, California.**

Fire Extinguisher

TRIGGER CONTROL has been extended to larger portable extinguishers as well as smaller sizes. Operated entirely with one hand, the new model is controlled by an upward pull of the index finger, the largest extinguisher requiring about the same trigger force as the smallest. It can be latched open when desired by a slight forward motion and as easily disengaged to avoid wasting gas. Trigger valve is small,

Eliminate DAMAGING WATER and OIL from Your Compressed Air Lines

WITH

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

Air Cooled to Within 10 DEGREES of Cooling Water! EASILY INSTALLED! Pipeline Construction

ADAMS equipment insures a constant supply of cool, moisture-free, oil-free air to power your compressed air tools with the highest efficiency and safety . . . at the *lowest* installation and maintenance cost.

ADAMS AFTERCOOLERS are *guaranteed* to cool air to *within 10 degrees* of your cooling water. This means *extra* thoroughness in condensing water and oil vapors from your compressed air.

NO FOUNDATION or other facilities are required for installation. The Adams "pipeline" construction permits the After-cooler and Cyclone Separator to fit right into a section of the pipe line . . . either vertically or horizontally!

CYCLONIC SEPARATION is the Adams principle . . . engineers agree that it is *far more efficient* than other mechanical separation!

WRITE!

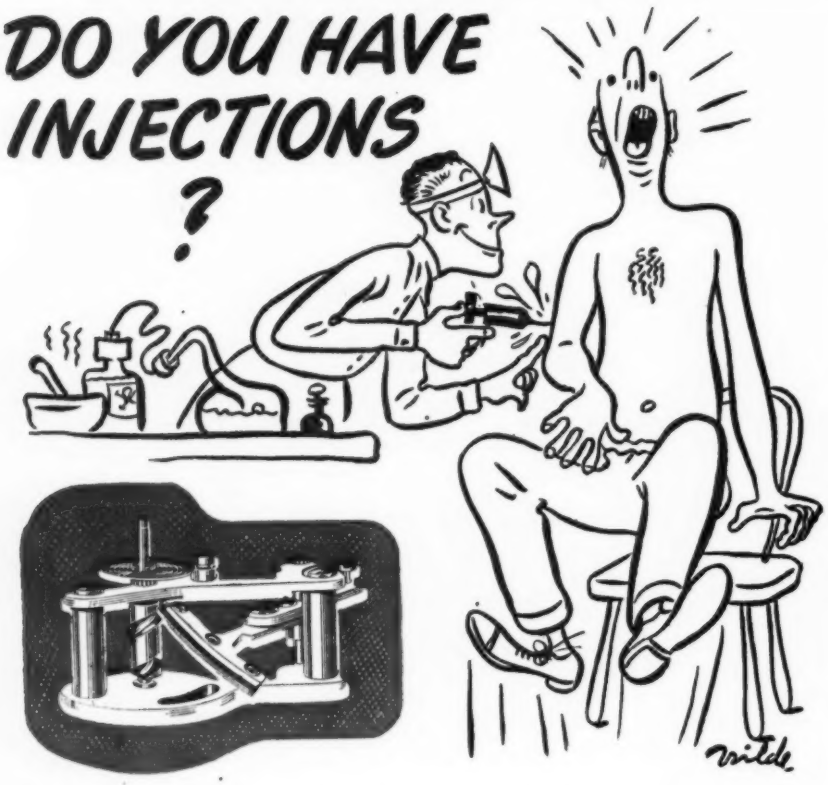
today for full engineering data on improved pneumatic power performance. Ask for Bulletin 703.

R. P. ADAMS CO., INC.

67 Chicago St., Buffalo, N, Y.

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

DO YOU HAVE INJECTIONS ?



WE hope you never have injections like injection molding machines. They get injections so rapidly and under such high pressures that the shocks are terrific. These machines for molding plastics require pressure gauges. Ordinary gauges made with spur geared movements can't take this punishment — they are wrecked in no time at all by the sudden and violent pressure fluctuations. But Certified Gauges can take it. Only Certified Gauges with the Helicoid movement stand up under such severe service.

This is only one typical example of how Certified Gauges are cutting down maintenance expense in industry. Most every plant has pressure gauge trouble — brief service life, frequent repairs, inaccurate indications. The answer to such trouble has been found by all those companies now standardizing on Certified Gauges.

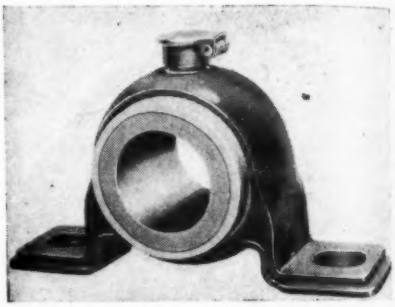
See your nearest Distributor.

Certified GAUGE
AND INSTRUMENT CORP.

34-18 Northern Boulevard — Long Island City 1, New York

compact, lightweight and simple in design. There is only one directional change in valve passage, avoiding loss of force and giving a full flow of liquid carbon dioxide direct to nozzle.

Streamlined one-piece handle closure protects valve itself. Other improved features of extinguisher as a whole are the permanent bushing and removable siphon tube, which allow inspection, periodic hydrostatic testing and, when necessary, replacement of any part without devalving. Locking pin fits into a blind hole so that there is no possibility of its getting bent and jamming; seal wire is placed where it is least likely to break and most easily observed. **Walter Kidde & Co, 140 Cedar St, New York 6, N. Y.**



Bronze-Bushed Bearing

TYPE F BRONZOIL BEARING for small shafts especially adapted for fan and blower service is fully self-aligning. A bronze capillary bushing that carries about one third of its volume of lubricant is used as a liner. This bushing has a shoulder which offers a broad, flat bronze bearing surface that is always lubricated and serves to reduce friction between bearing and collar, which positions the shaft. A liberal oil reservoir with a close-fitting wick surrounds bronze capillary bushing and supplies required amount of oil. Wick and oil cup are supplied with bearing. **Dodge Mfg Corp, Mishawaka, Ind.**

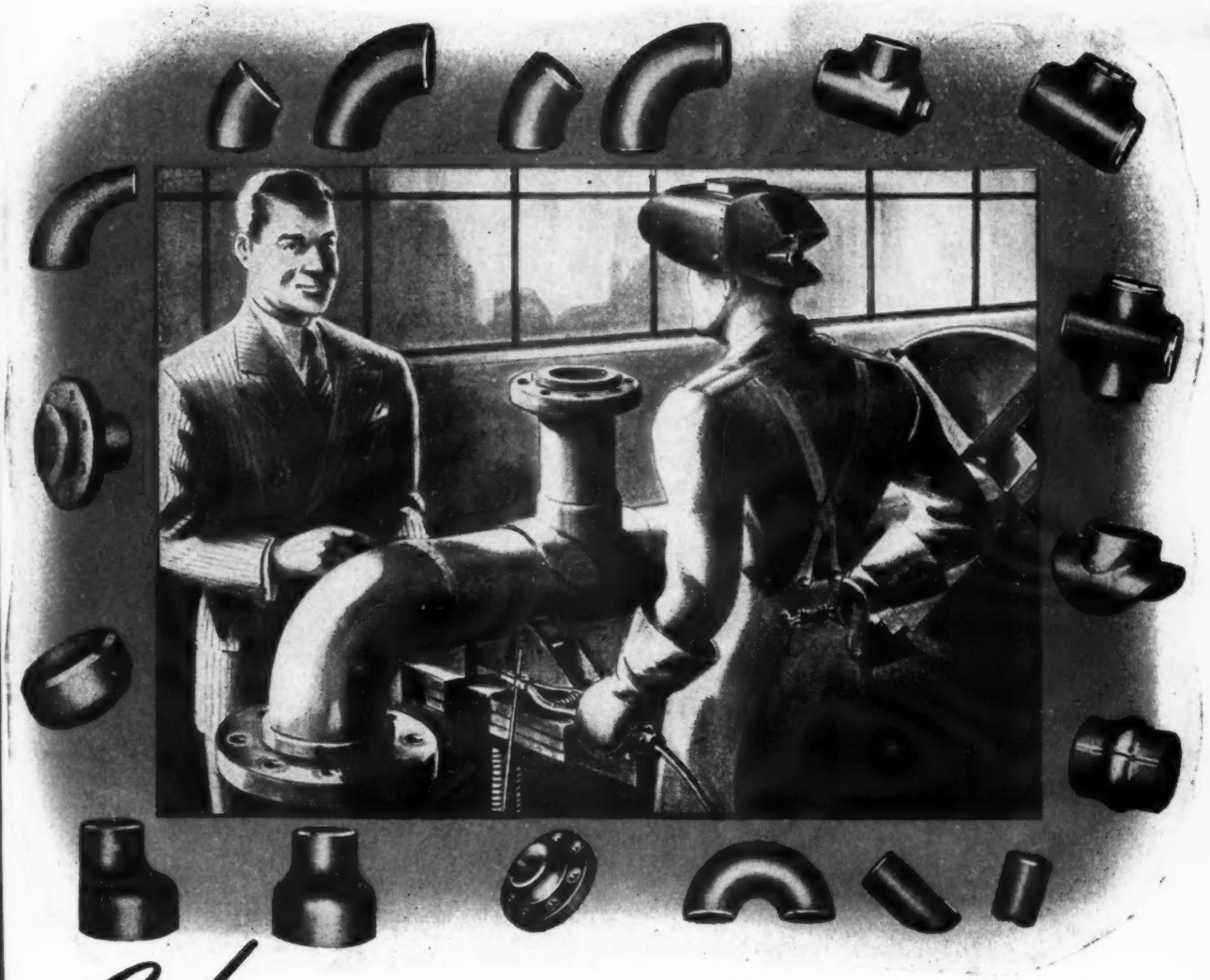
Maintenance Refractory

ZIRCOAT-M is a zirconium-silicate-base refractory, which upon application with a spray gun sets up rapidly to form a hard, dense working surface that withstands high furnace operating temperatures and unusual furnace conditions. It is a fine-grained material shipped dry in 100-lb bags. Mix *Zircoat-M* with water for spraying and use as a protective coating on silicon carbide, fireclay, sillimanite, mullite, silica, and other acid refractories. **Basic Refractories, Inc, 845 Hanna Bldg, Cleveland, Ohio.**

Air-Operated Valve

MANY REMOTE CONTROL PROBLEMS are solved satisfactorily with Hills-McCanna air-operated valve, in sizes ranging from 4 through 12 in. Westinghouse *Flexair* or *Controlair* controls, or both, together with an air-actuated piston mounted on the valve, operate it. *Flexair* control provides

(*Continued on page* 174)



Ask **THE WELDER OF PRESSURE PIPING**

what he thinks of

MIDWEST WELDING FITTINGS

You will find that he gives them hearty approval. Piping welders generally have a high appreciation of the exceptional dimensional accuracy and uniformity of Midwest Welding Fittings . . . their job is easier and they can turn out better work faster.

Midwest Welding Fittings have extraordinary dimensional accuracy because particular precautions are taken in their manufacture. Midwest Welding Elbows, for example, are made slightly oversized, then reheated to forging temperature and given a final accurate sizing in compression. This provides accurate dimensions, true circular section, and uniform wall thickness. Comparative corrosion tests as well as tensile and ductility tests have proved the beneficial effect of forging the metal in compression.

Welders also appreciate the wide variety of Midwest Welding Fittings . . . including "Long Tangent" elbows and reducing elbows. There is a fitting for practically every condition he encounters. Ask the local distributor or our nearest office for Bulletin WF-41.

MIDWEST

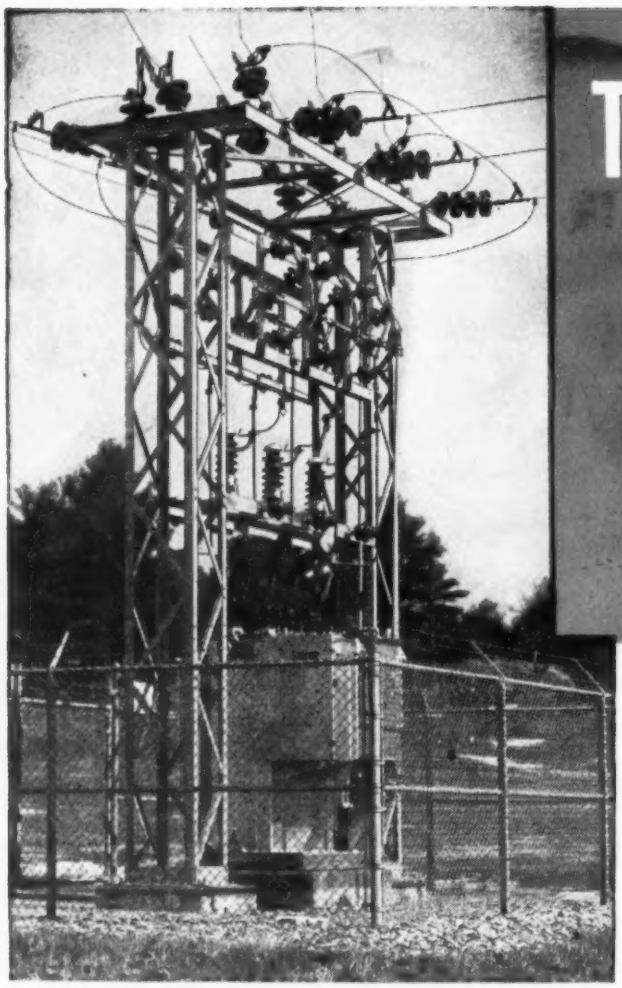
PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

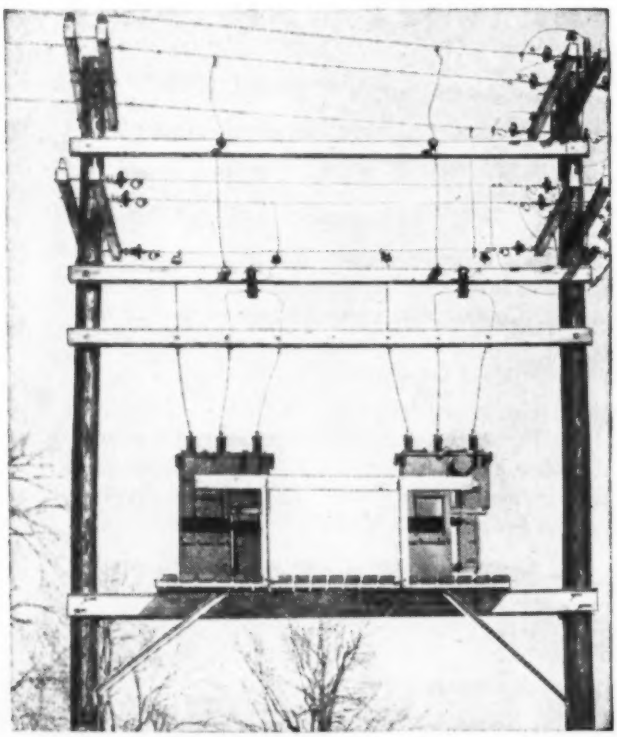
Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—[illegible] • Tulsa 3—[illegible] • Atlanta 3—[illegible] • South Boston 27—[illegible] • Distributors in Major Cities

The RIGHT VOLTAGE a

Here's every type of regulator you need, to have the right voltage—anywher



STEP REGULATORS (MLT-32)—For urban and rural circuits 69,000 volts and below. Provide 10% regulation raise and lower in thirty-two 5/8% steps. Ratings 104 to 750 kva, three-phase.



BRANCH STEP REGULATORS (ML-4)—For very low-cost regulation; 10% raise or lower in four 2½% steps on 2400-, 4800-, and 6900-volt feeders. Up to 51.8 kva, single-phase.

● It is now easy and inexpensive to extend the benefits of good voltage to every point of your distribution system—or to every nook and corner of your plant. Whether you need voltage regulation for urban feeders, rural lines, factory circuits, or laboratory, there is a simple, economical G-E device for the job.

A few ways these devices may be able to help you:

ON PRIMARY CIRCUITS

1. As an aid in maintaining service standards and keeping customer good will in the face of wartime distribution problems. Also, to iron out feeder-voltage problems.

2. To find "hidden kilowatts" (by releasing extra system capacity) without revamping present lines or adding new feeders. They're a "natural" for voltage problems that must be solved quickly. They make possible more effective use of equipment already on a system.

3. To make your system capacity more adaptable for postwar loads. Sudden shifts in population, drops in wartime loads or increased domestic and commercial loads can be taken care of more easily—often without changing generator or transmission facilities.

4. To reduce system costs. Actual case histories show annual savings of from $834 to $9950 on a single feeder.

ON SECONDARY CIRCUITS

1. For improved lighting (more constant light level); for better starting of fluorescent lighting; for increased lamp life;—by holding voltage at the proper level.

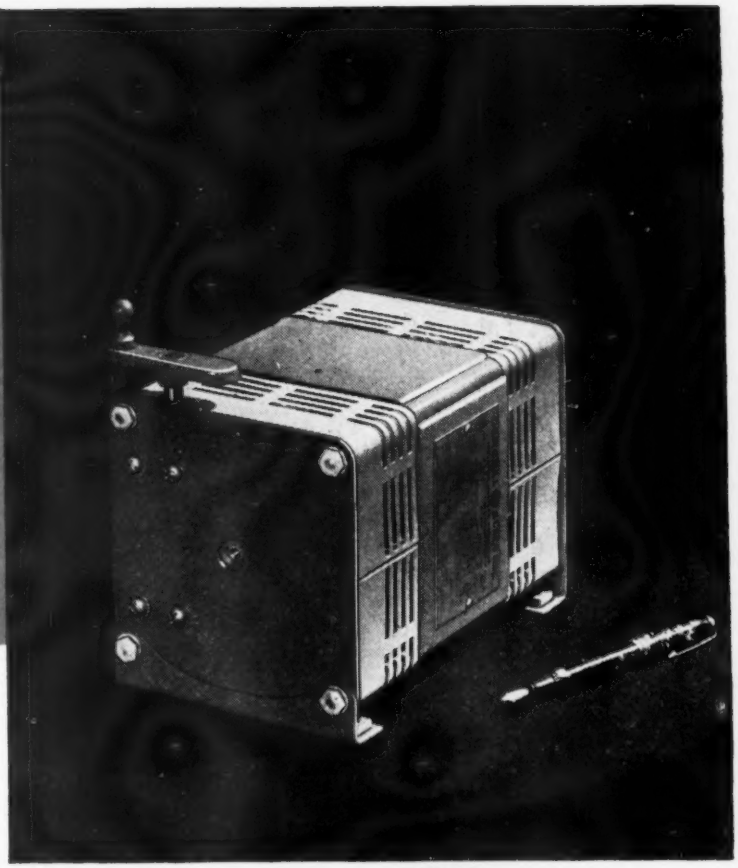
2. For greater production—by eliminating sluggish operation of motors and potential or control devices.

3. For longer life of electric equipment; for protection of precision electric devices, electronic tubes, etc;—by reducing overheating and burnouts.

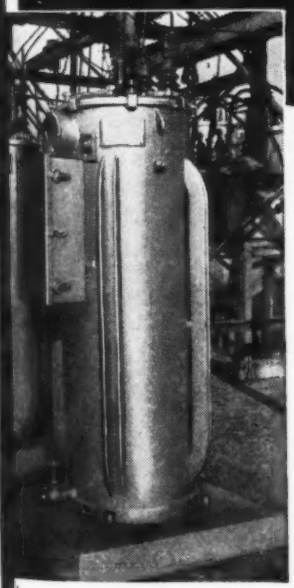
4. For the right voltage in your laboratory to assure accurate test results in less time.

The regulators shown at work on these pages are only representative of the many G-E voltage-improvement devices that are available to help you. We shall be glad to help you analyze your voltage problem to determine what corrective measures are necessary. *General Electric Company, Schenectady 5, N. Y.*

...e RIGHT PLACE Does the Job BETTER

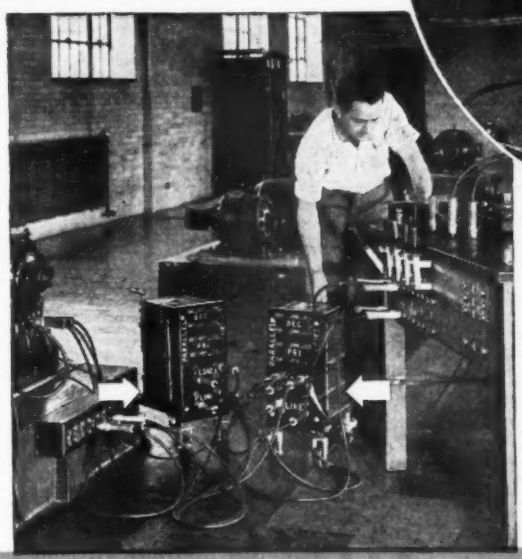


SMALL DRY-TYPE REGULATORS—For 120- and 240-volt circuits. 10% raise and lower or 100% raise and lower regulation. Up to 600 va, single-phase. 10% ratings available for automatic operation.



VOLTAGE STABILIZERS—Automatically provide a constant 115- or 230-volt supply to a given load, on circuits varying from 95 to 130 or 190 to 260 volts. Ratings from 50- to 5000-va output.

VARIABLE-VOLTAGE AUTOTRANSFORMERS — Provide smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243- to 810-va output for 115- and 230-volt circuits.



INDUCTION REGULATORS (IRS —oil-type or Pyranol for indoor or outdoor use)—Provide 10% regulation raise and lower on 2400-, 4800-, and 6900-volt feeders. 2 to 120 kva, single-phase. Also available three-phase.

DRY-TYPE REGULATORS (AIRS)—For secondary circuits. *Automatic type:* Provides 10% regulation raise and lower. *Remote-motor or hand-operated:* 100% raise and lower. Up to 12 kva, 600 volts, single-phase. Also available three-phase.

GENERAL ELECTRIC

During This Coal Crisis Know the Grades You Have to Burn . . . . . .

crush and sample automatically and quickly— process one ton in one hour . . .

WITH THE

STURTEVANT

Automatic

Coal sampling by the old-fashioned hand method of shoveling, hand-crushing, mixing, quartering, piling and rolling not only involves many slow, laborious operations but every chance of human error is always present. Samples are not representative even at an unnecessary expenditure of manpower.

WHY It Pays to Know Your B. T. U.'s

Only by taking accurate, truly representative samples can you know exactly the fuel value of the coal you buy, provide a correct basis for adjusting your plant to the efficient use of the coal delivered to your bunkers and assure freedom from shut down. By sampling coal the "Sturtevant Way" you can be absolutely certain of its B. T. U. value and thereby assure the maximum in plant performance, capacity and economy.

SEND FOR BULLETIN

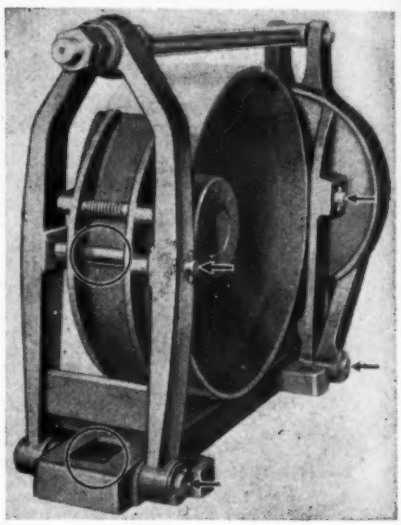
Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston 22, Mass.

simple open and shut operation. *Flexair* and *Controlair* offer opposed air operation so as to provide smooth throttling over a range wide enough to permit easy instrumentation. An auxiliary air tank provides shutoff in event of failure of main air supply. **Hills-McCanna Co, 3025 N Western Ave, Chicago 18, Ill.**

Disk-Shaped Ballasts

FOR OPERATION of 12-in. *Circline* fluorescent lamps, new disk-shaped ballasts are available in two single-lamp designs—either a conventional, uncorrected power-factor ballast, or a high power-factor, lead-circuit model without a step-up auto-transformer. A compensator is provided in the latter to raise starting current for use with a manually operated starter only. The leads of both designs are brought out through ballast cover plate and threaded through lamp stem for connection to lamps. **General Electric Co, Schenectady 5, N. Y.**



Shoe Brakes

TO FACILITATE REMOVAL of pivot pins where magnetic brakes are given frequent and heavy coats of protective paint or where mill dirt, moisture and weather conditions tend to corrode equipment, the pins on Type M shoe brakes are now protected by inclosing tubes. Length of tube completely inclosing exposed section of pin is fastened directly to bearing without touching pin. This leaves the pin free for speedy and easy removal. **Cutler-Hammer, Inc, 315 N 12th St, Milwaukee, Wis.**

Slime Inhibitor

NEW CHEMICAL DEVELOPMENT, with lime-solubilizing, fungistatic and detergent properties, inhibits slime growth and controls formation of lime-scale deposits in evaporative condensers and coolers. The material is a white powder, completely soluble, odorless and nontoxic. One ounce added to 10 gal of makeup water in sump is said to keep water sweet, prevent slime and hard lime scale from forming on coils, keep equipment clean and minimize need for maintenance. **Oakite Products, Inc, 23 Thames St, New York 6, N. Y.**

HOW INSULATION USERS SAVE TIME, WORK and MONEY with New PLANT-Pioneered..

for 85% Magnesia and High Temperature Pipe Coverings

Faster Application! Because the outside diameter of each size of pipe covering now is made to fit exactly inside another standard pipe covering size! Sectional sizes up to and including 18-inch pipe size!

Less Delay on Odd Thicknesses! Now they can be readily assembled from prime sizes!

Less Stock to Carry! Service every insulation need in your plant with just prime sizes! No odd left-overs, either —every piece is standard, readily usable material!

Better Service From Your Distributor! 48 per cent fewer items for him to handle! He now can order prime sizes from us in Solid or Broken-Joint construction. He can specify shipment of large lots direct to your job . . . meet emergency special requirements by assembling them in his own warehouse!

Write Today for new, handy "Digest of Simplified Thickness Standards."

Another Great "FIRST" by the makers of

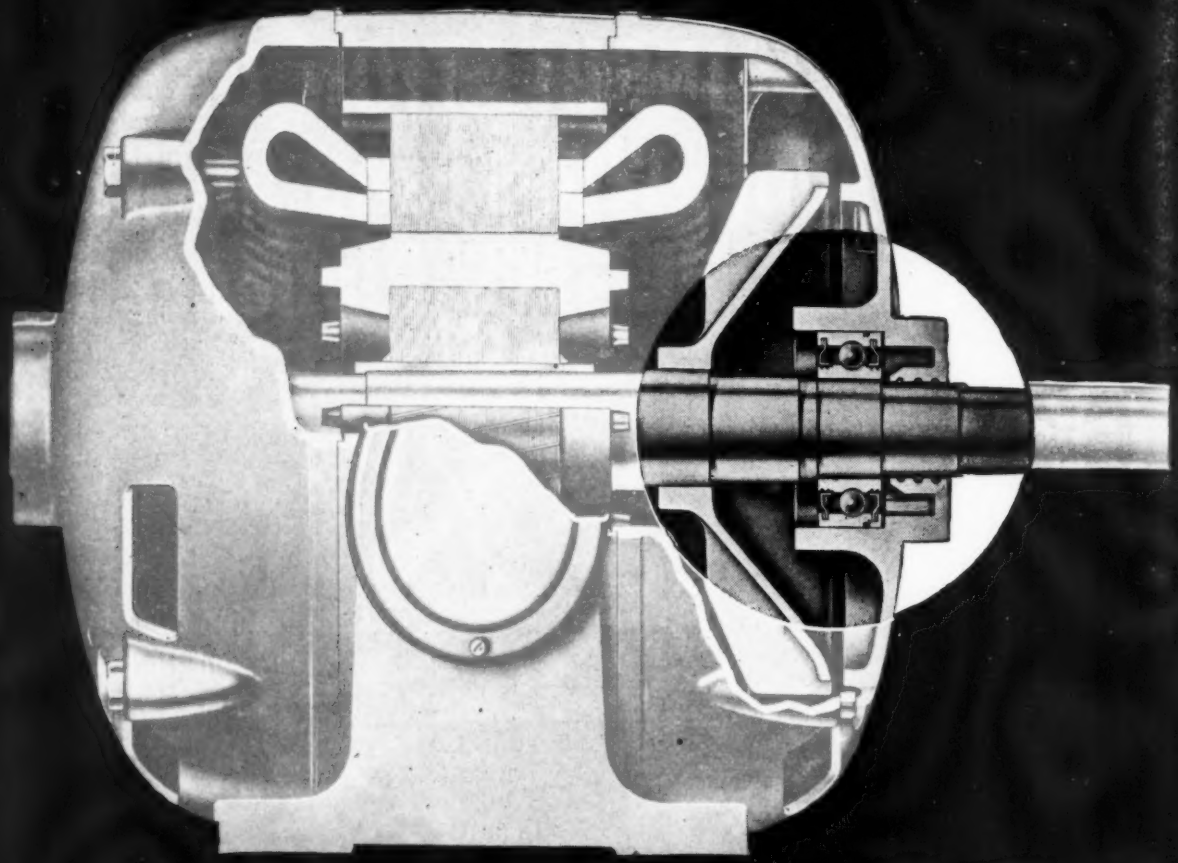
PLANT RUBBER & ASBESTOS WORKS

GENERAL OFFICES: SAN FRANCISCO - PLANT Engineering Service Units in Principal Cities - FACTORIES: Emeryville, San Francisco, and Redwood City, Calif.

Army-Navy "E" Awarded to FACTORY No. 3 Emeryville, Calif.

Manufacturers of Plant Insulating Materials and Mechanical Packings. Established 1898.

*U. S. Patents Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754.



these Westinghouse motors will run
twenty-four hours a day—
for five years or more—
with no greasing

eliminates frequent bearing lubrication

THE BIGGEST ITEM OF MOTOR MAINTENANCE

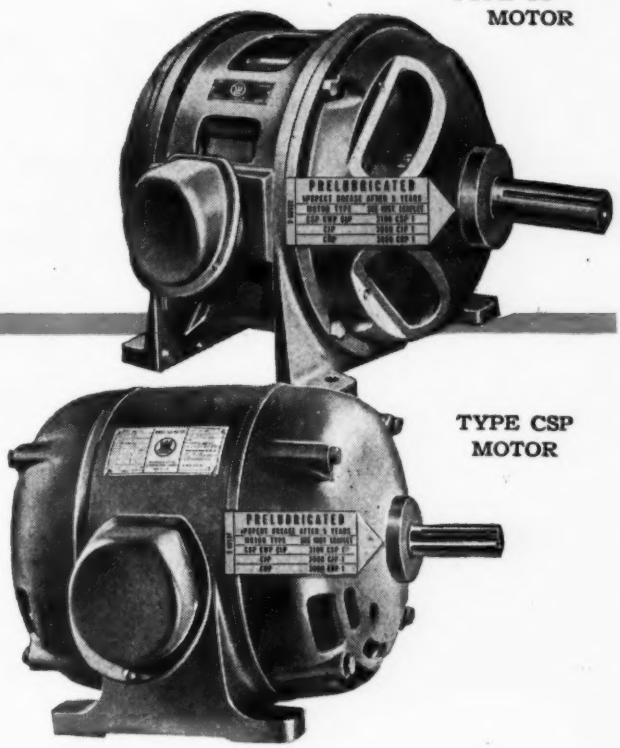
Another great step forward in the design of squirrel-cage motors of 15 horsepower and under (frames 326 and smaller) is being offered by Westinghouse. It's the Prelubricated Ball Bearing.

Instead of the periodical lubrication required by the bearings in conventional motors, the lubrication of these bearings can be forgotten for five years or more, even *when operating 24 hours a day.* The saving in time of maintenance crews is obvious, but there are other important advantages, too:

No overgreasing
No "skipped" bearings
No grease contamination
No grease seepage
No unreplaced pipe plugs

All these add up to longer bearing life and smoother motor operation through years of continuous service. For complete information, write for Bulletin B-3554 and Descriptive Bulletins 3100-CSP and 3100-1 to Westinghouse Electric Corporation, P. O. Box, 868, Pittsburgh 30, Pennsylvania. J-21342

TYPE CS MOTOR



TYPE CSP MOTOR

WESTINGHOUSE SPECIAL FEATURES

- **PRELUBRICATED SEALED BALL BEARINGS** reduce lubrication maintenance . . . assure longer grease life . . . eliminate extensive lubrication records.
- **IMPROVED TUFFERNELL INSULATION.**
- **DYNAMICALLY BALANCED ROTOR.**
- **DIE-CAST ROTOR** with over-size fan.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

WESTINGHOUSE SQUIRREL-CAGE MOTORS

PRODUCT OF RIGID CONTROL

ASSOCIATED FLANGES

Every flange manufactured by Associated is subjected to rigid control from start to finish. All material is analyzed before use. Manufacturing procedure is closely governed to assure uniformity in strength. They are far tougher than the toughest assignment they'll ever be given. Connect with Associated.

ASSOCIATED PIPING & ENGINEERING CO., Inc.
FLANGE DIVISION
2332 East 38th Street • Los Angeles 11, California

Power News

(*Continued from page* 130)

connection was maintained for emergency only, a great many of its benefits would be passed up, but such ties would provide prompt relief in an emergency. Many companies, which were under FPC jurisdiction before war interconnections were made, are much more extensively interconnected now and such additional ties are expected to be kept in full operation.

Exigencies of the war period probably caused a broader and faster adoption of automatic load-control devices and carrier-current-line relaying than would have been the case had the nation been at peace during the last four years. Use of these devices grew rapidly because they permitted considerably heavier line loading and increased greatly the reliability of lines they controlled. The war economies they demonstrated can be realized in peace to such a degree as to warrant expectation of their retention and expansion.

The war-born increase in kwhr per kw output—from 4600 in 1940 to 5560 in 1944—was based largely on three factors: (1) extra shifts in manufacturing plants, notably the third shift (2) lots of new industry, including some which virtually ran 24 hr a day, seven days a week (3) war time, which lowered evening peak loads. Since none of these factors is controlled by electric power industry, the wartime level of kwhr per kw output must drop as these factors drop.

Program of Activities for members of American Society of Heating and Ventilating Engineers Oct 6-8 in Cleveland, Ohio, includes meetings of the Council, Committee on Research and the Northern Ohio Chapter. Of interest to members will be inspection of the research laboratory at 10700 Euclid Ave. This will provide an opportunity for members to meet the laboratory staff, see some of the work that has been started and hear some of the results of recent investigations. In the afternoon a session will be held in the Pine Room, Hotel Statler, when three papers will be presented, followed by a social hour sponsored by the Northern Ohio Chapter. At 6:30 PM a dinner will be served in the Euclid Room of the hotel; the speaker will be Dr C E A Winslow, whose subject is *The Air-Cooled Human Body*.

Phelps Dodge Copper Products Corp is erecting a $4,500,000 rod, wire and cable plant at Fort Wayne, Ind. This plant will operate as a new division of company.

LET INGERSOLL-RAND AIR POWER WORK FOR YOU!

IT CAN...

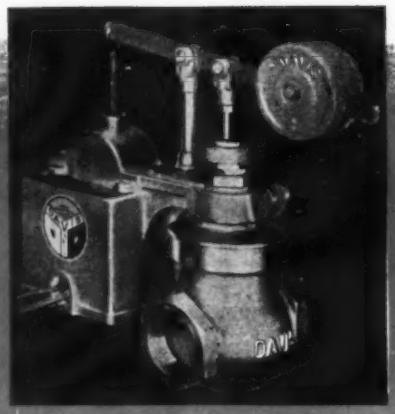
AERATE cultures as in yeast making
AGITATE liquids (by bubbling through them)
ATOMIZE water for humidification and washing
BLOW dust, dirt, scale, coal, soot
CONVEY grains, mail, packages
COOL materials and workers
CUSHION pistons and recoil mechanisms
DISPLACE liquids and gases
DRILL rock and metals
DRY fabrics, paper rolls
FORM rubber, glass, and wood in moulds
HAMMER rivets, nails, chisels, forgings
HOLD liquids under pressure
LIFT by piston or air-motor hoist
INFLATE tires, pontoons
OPERATE all kinds of Air Tools
OXIDIZE materials in furnaces and converters
PUMP water, oils, chemicals (by "air lift")
ROTATE grinders, motors, and machinery
SAND-BLAST against metal and stone surfaces
SCAVENGE spent gases from gun barrels
SPRAY paint, cleaning fluids, insecticides
SUPPLY air to mines, caissons, divers
VENTILATE rooms, tunnels, mines
VIBRATE sifters, mixers, concrete
WHISTLE as an alarm or signal

1-716

And a thousand-and-one other time- and money-saving jobs.

Ingersoll-Rand builds and applies both the COMPRESSORS that generate the AIR-POWER and the TOOLS that use it

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.



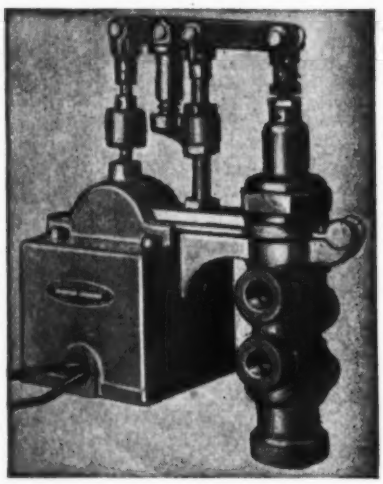
make it Automatic

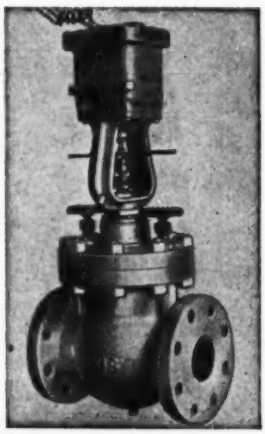
with Davis Industrial Type Solenoid Valves

• Freedom from manual control and from fear of disastrous failures is yours when you specify Davis Solenoid Valves. These valves are available for steam, gases and liquids in sizes from 1½" to 12" and pressure to 1500 lbs. Any device capable of making or breaking an electrical circuit will operate Davis valves. Available with either normally closed or open valves, explosion proof solenoid boxes and two step action when extreme accuracy is required.

Wherever an automatic valve will improve your piping system, be sure to write Davis engineers for recommendations. You'll be certain that Davis will furnish the right valve for the job. Informative literature available.

Below—No. 380—a 3 or 4-way pilot valve widely used on air or liquid actuated power cylinders.





Above—No. 93-H with solenoid operated pilot valve and hydraulically actuated main valve built for use on a 400 lb. pressure water main.

DAVIS REGULATOR COMPANY

2540 S. Washtenaw Ave. Chicago, Ill.

DAVIS REGULATOR COMPANY

Regulation Controls Utility Inventories

Priorities Regulation 32, which has controlled utility inventories since Order U-1 was revoked Sept 30, provides, with limited exceptions, that "a person may not accept delivery of any material if his inventory of that material is, or will be, more than a practicable working minimum inventory reasonably necessary to meet his own deliveries on the basis of his current or scheduled method and rate of operation." Suppliers are forbidden to make deliveries which they know or believe would, if accepted, be in violation of the regulation.

Principal item of electric utility interest on PR32's list of materials in short supply, and consequently subject to specific inventory controls, is copper-base alloy and copper, all of whose controlled material forms are listed in Table 1 as being scarce and are subject to a 60-day limitation on inventory or to practical working minimum inventory, whichever is smaller. This limitation includes wire, cable and foundry castings of copper or copper-base alloy.

Poles were not included on the list of items in short supply, but solder was and inventories of it are governed, according to PR32, by Direction 2 to Order M-43.

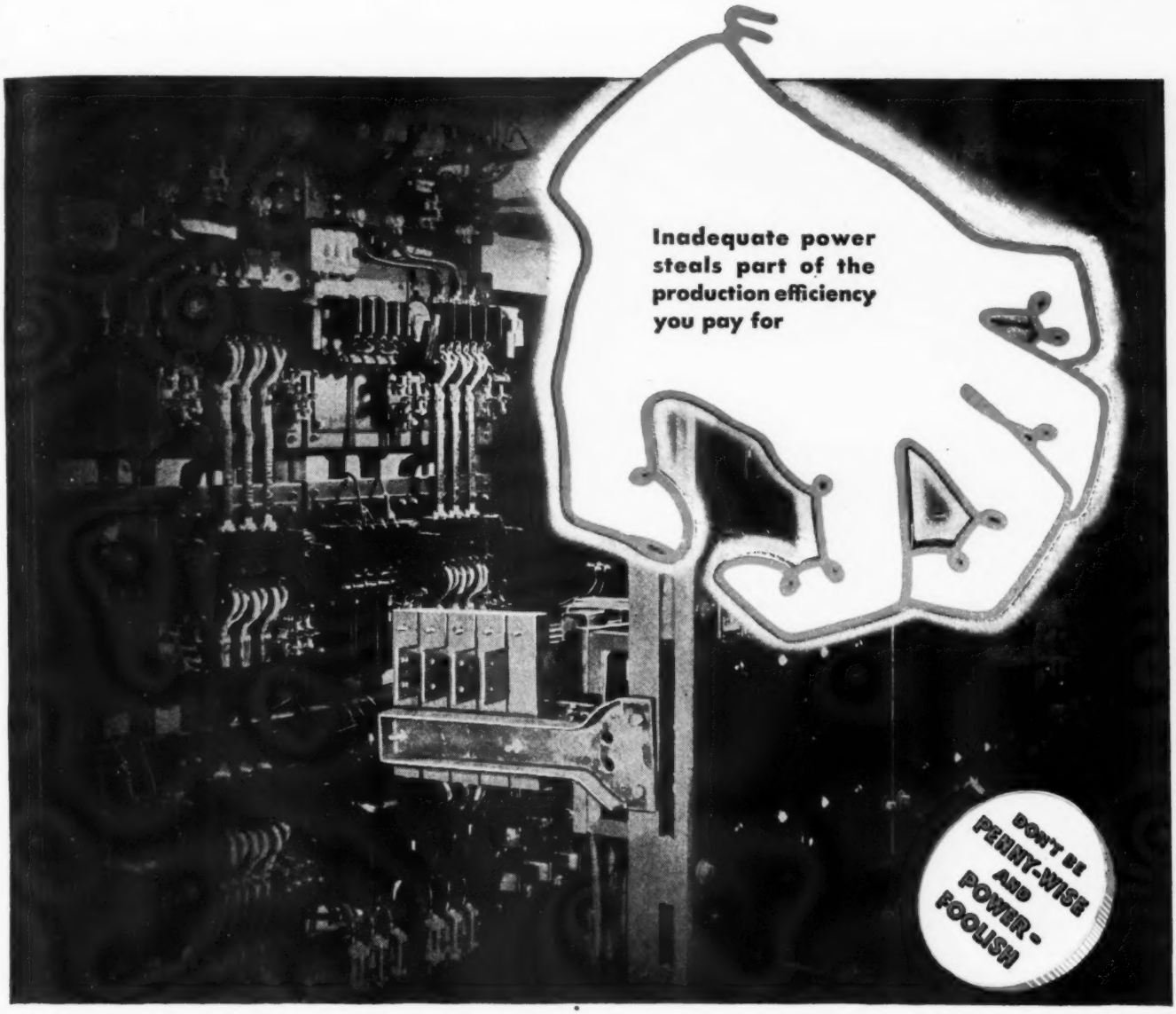
Table 3, a list of items exempted from the restriction of PR32, includes all forms of aluminum and other products.

It was emphasized that restrictions on ordering more material than needed, which formerly applied only to rated orders, now apply to all orders, except those for materials listed in Table 3, as being in plentiful supply. War Production Board officials pointed out that materials now tight will be removed from Table 1 as rapidly as possible and that materials in ample supply will be added to Table 3 quickly. The over-all inventory control regulation, however, will be retained "until materials are generally in ample supply."

Purchasers are not permitted to place orders for materials in greater quantities than they would be permitted to receive under PR32 even if they intend to cancel one or more of them before delivery. However, this restriction does not apply to orders for any material in Table 3. Where a purchaser's operations are changed through cutbacks or for other reasons after orders of materials have been placed, outstanding orders, acceptance of which would put him in violation of PR32's inventory limits, must be adjusted promptly. If necessary, deliveries must be postponed or cancelled.

F H McGraw & Co have received two contracts for new construction, aggregating $2,250,000, from the General Aniline & Film Corp. The first contract is for a powerhouse to be built for Ansco film div at Binghamton, N. Y. The new building will house three steam boilers, each with a steam output of 40,000 lb per hr, that will drive two turbine-generators of 300 kva each and two turbine-generators of 3000 kva each. The second contract is for a wash house at Rensselaer plant of general aniline works div in New York City.

(*Continued on page* 184)



Backward wiring handicaps advanced equipment

...Wire ahead

DON'T HOBBLE new, improved equipment for the sake of saving a few extra dollars worth of wiring.

Remember, to get peak efficiency from postwar production equipment wiring must come first—foresighted wiring to provide for greatly expanded power needs to come.

Check your wiring plans now. Avoid costly alteration shutdowns later. Call in your consulting or plant power engineer, electrical contractor or power salesman. Hear what *they* say about the wisdom of soundly planned wiring and service equipment. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities.

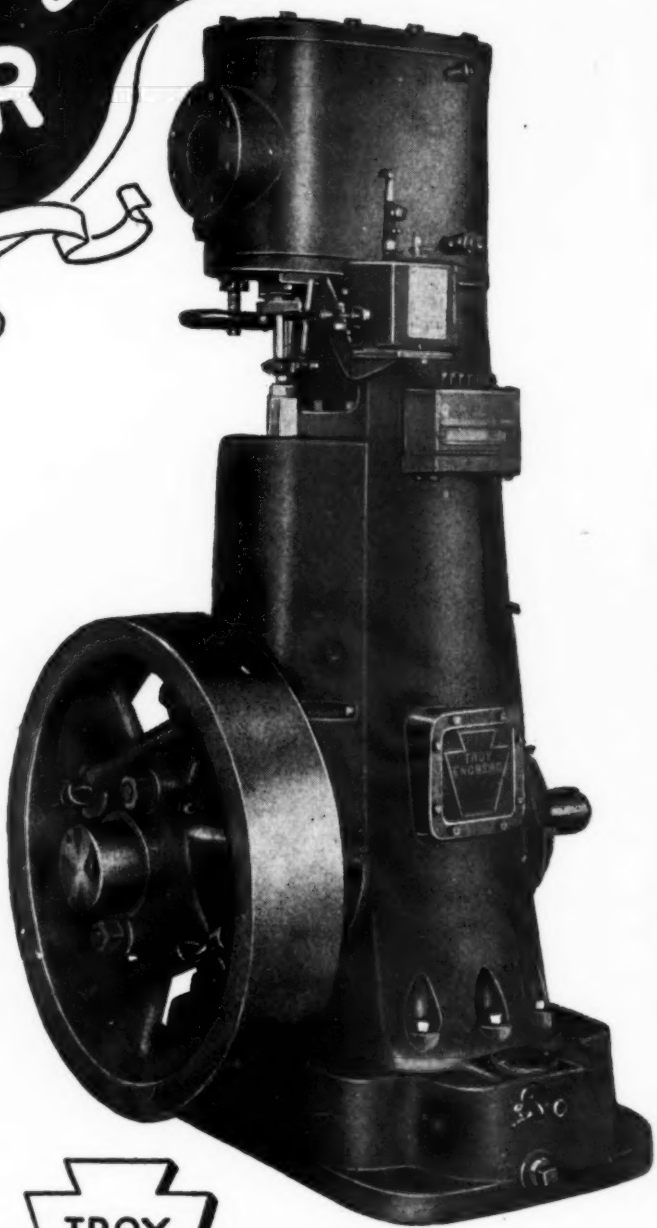
✓ *Check your wiring plans before they check you!*

HELP BRING VICTORY SOONER
...BUY MORE WAR BONDS

ANACONDA

ANACONDA WIRE & CABLE COMPANY

USE Steam Engine POWER



★ **FOR ECONOMY**

★ **FOR FLEXIBILITY**

★ **FOR DEPENDABILITY**

Troy-Engberg Steam Engines are the most economical drive obtainable when plant heat balances are right, as they are in many plants. In these cases, generally power costs are so low as to completely pay off all investment and installation costs in a few months or a year or two.

That Troy-Engberg Engines are flexible is evidenced by the fact that many companies, including utilities, have installed them for driving stokers on boilers operating under widely fluctuating loads.

As for dependability, we refer you to oil refineries where many Troy-Engberg Steam Engines are driving those important charging and transfer pumps. Dependability is the first requirement.

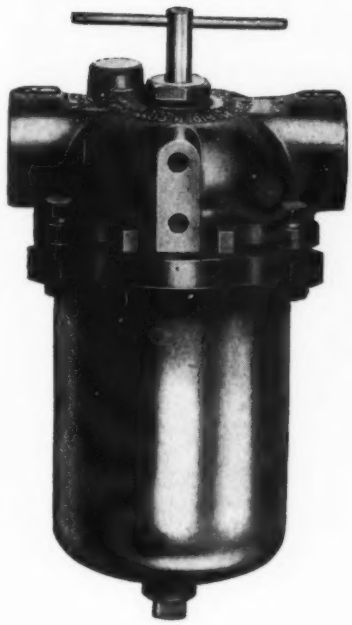
The modern reciprocating Troy-Engberg Steam Engine has so much to offer that its use should be considered for every drive in your plant. Single engines range up to 225 hp, vertical or horizontal; duplex, up to 450 hp.

TROY ENGBERG

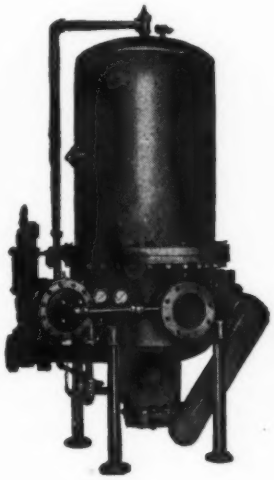
TROY ENGINE & MACHINE CO.

Established 1870

2503 RAILROAD AVENUE TROY, PENNSYLVANIA



AUTO-KLEAN disc-type. For all fluids except those containing highly abrasive solids. Viscosities from 30 to 50,000 Saybolt Seconds. Sizes from 1¼" diam. x ⅞" cartridges to massive motor-driven models. With variety of built-in types.



FLO-KLEAN wire-wound. For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. Low pressure drop — fluid moves in straight line, encountering only momentary restriction. Constructions to meet varying corrosive and erosive conditions.

KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

CLEANING THE FILTER WON'T STALL THE FLUID

"Continuously-cleanable" is a big reason why both machine builders and production men prefer the Cuno filter

Machine builders appreciate the *compactness* of the Cuno — possible because the continuously-cleanable feature means no duplex installation is required for full flow. The Cuno filter occupies no more space than the usual partial-flow type.

Production men like the *uninterrupted flow*. Cleaning the filter is done while the filter is still working. Turning a handle (by hand or by motor) cleans the Auto-Klean; a motor-driven backwash system cleans the Flo-Klean. Nothing, in either case, to remove or renew.

The Cuno catalog in SWEET'S tells where to use Auto-Klean, where to use Flo-Klean (the latter generally in cases where the fluid-borne particles are highly abrasive). Positive cleaning action is effective down to .0025" size . . . minimum pressure drop . . . permanent, all-metal filter elements — in both cases.

Apply direct to Cuno for complete catalog (use coupon) or for the recommendation of the Cuno engineering staff.

CUNO ENGINEERING CORPORATION
129 South Vine Street, Meriden, Conn.

Please send me a free copy of your new catalog. I am especially interested in the services checked.

☐ Acids	☐ Gases	☐ Paint
☐ Air	☐ Gasoline	☐ Pyroxylin
☐ Alkali	☐ Grease	☐ Quenching Oil
☐ Boiler Feed	☐ Grinder Coolant	☐ Resins
☐ Casein	☐ Hydraulic Oil	☐ Rust Proofing Compounds
☐ Cleaning Solutions	☐ Japan	☐ Sizing
☐ Coatings	☐ Lacquer	☐ Solvents
☐ Compressed Air	☐ Lubricating Oil	☐ Spray Systems
☐ Coolants	☐ Machine Tool Cutting Oil	☐ Tar
☐ Cutting Oils	☐ Machine Tool Hydraulic Oil	☐ Test Stand Lubricating Oil
☐ Dip Tank Systems	☐ Machine Tool Lubricating Oil	☐ Varnish
☐ Enamel	☐ Nitrocellulose Solutions	☐ Washing Compounds
☐ Engine Fuel	☐ Oils	☐ Water
☐ Engine Lubricating Oil		☐ Wax
☐ Fuel Oil		
☐ Fuel Tar		

Others .....

Name .....

Company .....

Address .....

ADSCO HEAT EXCHANGERS

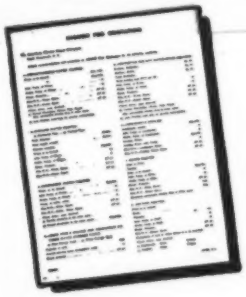
FOR HEATING . . .

Water for Washroom service ★ Water for process requirements ★ Water for space heating systems ★ Feed water ★ Water for swimming pools ★ Brine ★ Water for air conditioning ★ Fruit Juices and other liquids ★ Molasses, oils, tars and other viscous liquids ★ Gasoline ★ Fuel Oil ★

FOR COOLING . . .

Condensate ★ Water for drinking water systems ★ Water for air conditioning ★ Quenching and cutting oils

FOR CONDENSING STEAM AND OTHER VAPORS



MAIL coupon for this SIMPLE FORM that makes it easy for you to get quotation.

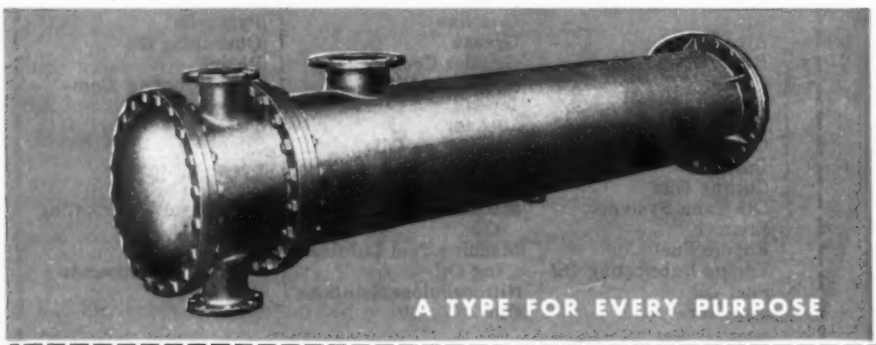
The above is only a partial list of uses for which Adsco builds Heat Exchange equipment. If the exact purpose for which you require such equipment is not listed, chances are Adsco can build it. In some cases, your specific requirements can be met with Standard Adsco Equipment, in which case there would be certain advantages in cost and delivery. Often, however, it is necessary to design and build equipment to fill your space requirements and operating needs.

In either case you will benefit from Adsco's long experience in designing and building Heat Exchangers for a wide range of uses—experience that has given Adsco the engineering skill to analyse your problems—and recommend, or design and build the equipment to meet your exact requirements. Mail the coupon for the simple form illustrated above.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N. Y.

MAKERS OF "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 65 YEARS



American District Steam Company
North Tonawanda, New York

☐ Please send REQUEST FOR QUOTATION FORM

☐ Please send me Catalog PR describing Adsco Heat Exchange Equipment.

NAME_____ TITLE_____

FIRM_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Engineers' Society Holds Pittsburgh Conference

Sixth Annual Water Conference of Engineers' Society of Western Pennsylvania will be held in the Hotel William Penn, Pittsburgh, Pa., on Oct 22 and 23.

The papers of interest to power engineers include: *Experimental Studies of Boiler Scale at 1500 psi* by J A Holmes, asst vice-president, National Aluminate Corp, Chicago, Ill.; *How to Evaluate Data* by V V Kendall, corrosion engineer, National Tube Co, Pittsburgh, Pa.; *Behavior of Highly Concentrated Boiler Water* by C E Kaufman, V M Marcy and W H Trautman, research engineers, Hall Laboratories, Pittsburgh, Pa.; *Cold-Water Vacuum Deaeration (results, operating data and costs)* by Sheppard T Powell, chemical engineer, Baltimore, Md.; *Construction and Maintenance of Water Wells* by N E Gunderson, Layne Northern Co, Mishawaka, Ind.; *Ionic Exchangers* by F K Lindsay, technical director, Zeolite dept, National Aluminate Corp, Chicago, Ill.; *Electrolytic Water Softening for Industrial Purposes* by R E Briggs, Metropolitan Water District of Southern California, San Dimas, Calif.; *Diatamaceous Earth Filtration* by H E Holberg, vice-pres, and H N Armbrust, engr, Proportioneers, Providence, R. I.

Army Releases Surplus Industrial Power Plants

Thirteen industrial power stations are included in a list of 252 manufacturing plants, which the Army announced recently it would release as surplus to the Surplus Property Board for disposition by Reconstruction Finance Corp.

The power plants originally had a total capacity of 150,500 kw, although some small units are known to have been moved out of their original stations for use elsewhere. It was not immediately known how much of the original capacity remained in place. The plants contained a total of 66 generating units, of which 28 were driven by steam turbines, the remainder by steam and gas or diesel engines. Largest units were three 7500-kw steam turbines in the Missouri Ordnance Works, Louisiana, Mo.

RFC officials said the plants had not yet been certified to their agency for disposal by the SPB. Every attempt will be made to sell the plants as a whole, including power facilities and as much of the real estate as possible. One official indicated it will be a long time before electrical equipment in the plants are sold separately.

It was not immediately clear to what extent conflict might arise between RFC's policy of attempting first to sell the plants as a whole and whatever desires the Interior Dept, or other government agency, might have toward acquiring certain surplus generating capacity. Interior Dept is believed to be interested in acquiring either equipment or output of at least two of the power stations, those at surplus ordnance works at Pryor, Okla., and Baxter Springs, Kan. These are respectively 40 miles south and 80 miles north of Grand River

(*Continued on page* 186)

NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library Up To Date With This Convenient Service

1 SPRAY NOZZLES — Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa. 16-page bulletin No. N-616 describes Yarway spray nozzles for water cooling, air conditioning and general industrial uses.

2 FANS AND BLOWERS—Buffalo Turbine Corp, 2165 Bailey Ave, Buffalo 11, N. Y. 4-page bulletin No. 745 gives condensed description and typical performance curve of axial-flow high-pressure fans and blowers.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **SPRAY NOZZLES**—Cooling Equipment Div, Binks Mfg Co, 3114 Carroll Ave, Chicago, Ill. 8-page bulletin No. 450 covers standard spray nozzles for air washing, cooling, brine refrigeration and allied applications.

★ **COOLING TOWERS**—Cooling Equipment Div, Binks Mfg Co, 3114 Carroll Ave, Chicago, Ill. 12-page bulletin No. 800 describes Type S atmospheric spray cooling towers in capacities ranging from 10 to 1200 gpm. 8-page bulletin No. 900 introduces small-series Type 2K all-steel-induced-draft cooling towers in capacities ranging from 40 to 600 gpm.

3 REPAIR EQUIPMENT — Ideal Commutator Dresser Co, Sycamore, Ill. 36-page booklet covers motor-generator maintenance and presents repair equipment for reconditioning machinery.

4 REPLACEABLE-FACE HAMMER—Greene, Tweed & Co, Bronx Blvd at 238th St, New York 66, N. Y. Bulletin No. B-2 provides construction features of Basa replaceable-face hammer.

5 CUTTING TORCHES AND TIPS — Victor Equipment Co, 844 Folsom St, San Francisco 7, Calif. 36-page publication (Form 52) gives detailed information on Victor hand and machine cutting torches and tips.

6 LUBRICATING SYSTEM — Farval Corp, 3248 E 80th St, Cleveland 4, Ohio. 4-page folder, entitled "When You Reconvert," points out advantages of the centralized lubricating system when installing machine equipment for postwar operations.

7 LUBRICATING UNIT—Dura metallic Corp, 2104 Factory St, Kalamazoo 24F, Mich. 4-page bulletin describes Dura pressure unit for circulating lubricating oil at uniform pressures.

8 WIRE STRIPPERS—Ideal Commutator Dresser Co, 1291 Park Ave, Sycamore, Ill. Folder presents features of different models of wire strippers.

9 ENGINES—Sterling Engine Co, Buffalo 13, N. Y. 12-page catalog describes specifications of marine and stationary diesel, gasoline and gas engine line.

How To Order Your Bulletins

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each catalog or bulletin you want, detach along the scored lines and drop the card in the mail.

Example

Write in circle number of item describing one catalog wanted → (17)

Company Name Brown Mfg. Co.

Address 3718 First Avenue

Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

10 RING GASKETS—Steel Improvement & Forge Co, 970 E 64th St, Cleveland 14, Ohio. 8-page booklet No. 45, entitled "Gruv-Seal, Forged Iron and Alloy, Ring Gaskets," covers ring-gasket line. Booklet gives complete information and buying data on forged gaskets of ingot iron, nickel, chromium and monel.

11 GOVERNORS — Allis-Chalmers Mfg Co, Milwaukee, Wis. 24-page bulletin No. B6356 discusses centralized control provided by modern governors for large hydroelectric units.

12 CRUSHERS — American Pulverizer Co, 1349 Macklind Ave, St. Louis 10, Mo. Bulletin presents special features of American Rolling Ring and Hammermill crushers, grinders and shredders for metal turnings, coal, stone and a wide variety of friable, semiabrasive and fibrous materials.

13 AIR COMPRESSORS—Schramm, Inc, West Chester, Pa. 44-page catalog covers complete line of Schramm stationary and portable compressors.

14 MOTOR CONTROLS—Electron Equipment Corp, 917 Meridian Ave, S Pasadena, Calif. 4-page bulletin No. 178 gives operating features and applications of electronic motor controls.

15 TEMPERATURE CONTROLS—Sterling, Inc, 3738 N Holton St, Milwaukee 12, Wis. 4-page bulletin No. 451 contains complete data on sizes, capacities and temperature ranges, as well as photographic illustrations and dimensional drawings, of temperature controls for tank and process installations.

16 ELECTRICAL-RESISTANCE MATERIAL—Keystone Carbon Co, Saint Marys, Pa. 4-page folder gives a brief description of Keystone negative-temperature coefficient resistance material. This product is defined as a material whose electrical resistance decreases with rising temperature.

17 PACKINGS—Greene, Tweed & Co, Bronx Blvd at 238th St, New York 66, N. Y. 8-page bulletin No. P-3 describes construction and service of Palmetto packings.

18 MATERIALS-HANDLING EQUIPMENT—R G LeTourneau, Inc, Peoria, Ill. 24-page booklet No. G-1066 presents latest information on modern, high-speed earthmoving and lifting equipment.

19 FRACTIONAL-HP DRIVES — Dept 655, American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa. Catalog contains complete price lists and specifications on new line of fractional-hp sheaves and belts. It also includes condensed and simplified drive tables for a wide range of center distances and drive ratios for this equipment.

(See other side for additional bulletins)

FILL OUT AND MAIL TODAY! NOT GOOD AFTER JANUARY 1, 1946

Write in circle number of item describing one catalog wanted → ( )

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Address .....

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POWER, 330 West 42nd St., New York 10/45

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Company Name .....

Address .....

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Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 10/45

20 EXTENSIBLE-TIP SPLICE — Manhattan, Rubber Mfg Div, Raybestos-Manhattan, Inc, Passaic, N. J. Bulletin No. 6861 describes the Manhattan extensible-tip splice and how it prolongs the life of Condor endless belts with extended-area stress relief.

21 HEAT-RESISTANT ALLOY—Callite Tungsten Corp, 540 39th St, Union City, N. J. 4-page bulletin No. 158 presents Callinite, a high-conductivity facing material for high-current applications where pitting, sticking or welding of contacts may occur.

22 BEARING METAL — Shook Bronze Corp, Lima, Ohio. 16-page catalog No. 45 introduces Shook 664 phosphor bronze for bushing, bearings, bars, etc.

23 LIQUID METER VALVES—Morganite Brush Co, Long Island City 1, N. Y. 6-page booklet covers Morganite liquid meter valves and slides.

24 FLOWMETER—Fischer & Porter Co, 9607 County Line Rd, Hatboro, Pa. Bulletin No. 82-A discusses new Rotasleeve rotameter for measuring large flows of liquids and gases.

25 VALVES—Wm Powell Co, Cincinnati 22, Ohio. 20-page booklet, entitled "Powell Valves for Corrosion Resistance," describes complete valve line.

26 VALVES AND SPECIALTIES—J E Longergan Co, 2nd & Race St, Philadelphia 6, Pa. 4-page condensed catalog No. 502-A covers safety valves, relief valves, pressure gages and specialties.

27 COLD-WATER DEAERATION—Cochrane Corp, 17th St & Allegheny Ave, Philadelphia 32, Pa. 4-page reprint No. 43 discusses deaerators for removing oxygen and carbon dioxide from cold process waters.

28 WATER TREATMENT—American K A T Corp, 331 Madison Ave, New York 17, N. Y. 4-page bulletin No. 33, entitled "The Modern Way to Avoid Boiler Troubles," presents the all-colloidal water treatment.

29 DUST COLLECTOR—Aerotec Co, % Thermix Engrg Co, First National Bank Bldg, Greenwich, Conn. Bulletin No. 101 covers problem of efficient fine-dust collection.

30 INDUSTRIAL SAFETY—National Safety Council, 20 N Wacker Dr, Chicago 6, Ill. 16-page pamphlet, entitled "Industrial Safety Tomorrow," outlines a program to help industry meet threat of an increased accident toll under changed conditions of the postwar period.

31 PRINTER AND DEVELOPER — Charles Bruning Co., 4754 Montrose Ave, Chicago 41, Ill. 4-page booklet describes Model 41 printer and developer for making black-and-white prints.

32 FLANGE TOOLS—T G Persson Co, 224 Glenwood Ave, Bloomfield, N. J. Sheet presents Flange-Jacks, which are tools for opening of flanges on existing pipelines for renewal of gaskets. Operation of Flange-Jacks is also covered.

33 GRAPHIC INSTRUMENTS—Esterline-Angus Co, P O Box 596, Indianapolis 6, Ind. 16-page booklet, entitled "Solving Industrial Crimes—Case No. 31," discusses graphic meters for detecting waste, testing machines, materials and men and improving processes and products. A case history of an arch welding dept in an industrial plant is given.

34 OSCILLATING-TROUGH CONVEYOR—Link-Belt Co, 307 N Michigan Ave, Chicago, Ill. 4-page folder No. 2088 covers the new Link-Belt oscillating-trough conveyor for handling sharp, jagged, abrasive, wet, oily or hot material. Conveyor comes in short- and long-hanger construction.

35 REFRACTORY COATING — Brickseal Refractory Co, 1029 Clinton St, Hoboken, N. J. 4-page bulletin describes Brickseal refractory coating, which is applied to refractory brickwork or plastic refractories by paint brush or spray gun. This coating is available in four grades to suit various operating temperatures.

36 PACKINGS—Packings Dept, Graton & Knight Co, 375 Franklin St, Worcester 4, Mass. 12-page folder, entitled "Packings Pointers," consists of twelve articles on the subject. This folder gives much helpful information for the design engineer in respect to selection of cup, flange, U- and V-packings.

37 PORCELAIN PLUNGERS—Aldrich Pump Co, Allentown, Pa. 6-page data sheet No. 57-2 describes Kosmos porcelain plungers, which can be used on almost any hydraulic pump, up to 2000 psi. Data sheet also gives complete construction details, specifications, types of service and purchasing information.

38 ALUMINUM-BRONZE ALLOYS — Ampco Metal, Inc, Milwaukee 4, Wis. 4-page bulletin No. 55 discusses Ampco metal in gear applications. Bulletin contains a table showing preferred grades of Ampco metal for various gear service. It points out common causes of gear trouble are breakage, deformation, wear or flaking and pitting of teeth.

39 SILICONE COMPOUNDS — Dow Corning Corp, Midland, Mich. 12-page catalog lists all of Dow Corning silicone products now available and contains many charts and graphs demonstrating unusual properties of these organo-silicon-oxide polymers.

40 GAS-ENGINE-DRIVEN COMPRESSOR—Clark Bros Co, Olean, N. Y. Sheet presents the Clark BA 2-cycle compressor. Construction features and advantages of this new compressor are included. The BA compressor is available in three sizes.

41 GAS WELDING — Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 16-page catalog No. 40 contains illustrations, descriptions, engineering data and current prices of Airco gas welding and cutting supplies and accessories. Ordering is facilitated by the listing of sizes and stock numbers in easily read columns. Booklet also lists addresses of Airco offices throughout the country.

42 CENTRIFUGAL BLOWERS—Eclipse Fuel Engrg Co, Rockford, Ill. Sheet No. K-901 describes McKee centrifugal blowers for supplying pressure air to combustion equipment.

43 BALL AND ROLLER BEARINGS—Gwilliam Co, 360 Furman St, Brooklyn 2, N. Y. 16-page catalog No. 21 lists sizes, varieties and prices of Gwilliam ball and roller bearing line. Diagrams and photographs of equipment are included.

44 COLOR CONCEPTS — McDougall-Butler Co, Evans, Water & Norton St, Buffalo 5, N. Y. Technical bulletin, entitled "New Concepts of Color," gives facts about correct paint colors for interiors of buildings for improving efficiency of employees. A number of case studies of plants are included.

45 RELAY EQUIPMENT — General Electric Co, Schenectady 5, N. Y. 4-page bulletin No. GEA-4396 explains operation of winding-temperature relay equipment which permits utilization of maximum permissible emergency-overload capacity of power transformer under all ambient temperature conditions.

46 WELDING EQUIPMENT — Chicago Tool & Engrg Co, 8383 S Chicago Ave, Chicago 17, Ill. 4-page booklet No. 610 gives underwater cutting and welding methods with Palmgren Arc-Oxygen cutting torch kit. Photographs and descriptions of torch units are included.

47 HOIST DRIVE—General Electric Co Schenectady 5, N. Y. 12-page bulletin No. GEA-4302 presents a new hoist drive for cranes, known as the Maxspeed system, which automatically "measures" the load so that it is hoisted and lowered at maximum safe speed yet prevents handling of dangerous overloads. It is for either indoor overhead, slow-speed cranes or high-speed cranes for outdoor construction. Drive operates from either ac or dc incoming power.

48 GASKET MATERIAL—Flexrock Co, 3677 Filbert St, Philadelphia 4, Pa. 4-page leaflet discusses Plastic-Gasket, a gasket material that can be applied to surfaces of flanges, etc, about 1/64 in. thick, with knife or fingers. Plastic-Gasket is said to prevent leakage, oxidation and corrosion.

49 INFRA-RED UNITS — Carbomatic Corp, 117 W 63rd St, New York 23, N. Y. Sheet describes two portable electric infra-red units for reflector (R40 and RE40) infra-red or drying lamps. Prices of equipment are given.

50 CHAIN SLINGS—Hercules Sling Co, Rockford, Ill. 4-page folder covers Safe-T-Lift automatically equalizing chain slings, made in 4- 7- 14- 25- and 40-ton capacities. Folder gives a general description and operation of these slings. Photographs of Safe-T-Lift slings are also included.

51 SAFETY CLOTHES — Standard Safety Equipment Co, 232 W Ontario St, Chicago 10, Ill. 6-page folder furnishes style numbers, sizes and prices of StaSafe fabric garments and aprons for extra safety. Folder also contains a schedule of extra charges for additional features on garments.

52 INDUSTRIAL ADHESIVES—Advertising Dept, Minnesota Mining & Mfg Co, St. Paul 6, Minn. 12-page booklet, entitled "3-M Adhesives in Industry," should be interesting and helpful to users of adhesives, sealers, coating or insulating compounds, impregnators and sound deadeners. Booklet describes adhesive operations in different industries and methods of application. It also lists physical properties of these adhesives.

53 LIGHTNING ARRESTERS — General Electric Co, Schenectady 5, N. Y. 4-page bulletin No. GEA-4437 contains complete information on dry nitrogen-filled pellet arresters for protection of apparatus on distribution circuits 15,000 v and below.

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MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company — "Bridgeport" — *Headquarters for BRASS, BRONZE, and COPPER*

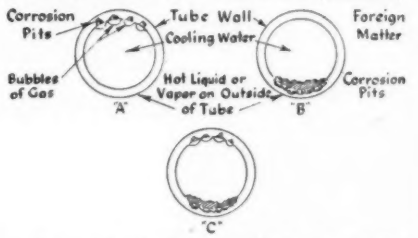
Effect of Temperature on Tube Life

The rate of corrosion is generally increased by rising temperature. This was discussed in the August issue. Yet, there are circumstances where an elevated temperature is responsible for reducing the corrosion rate. For example, with certain waters, evaporation or an increase in temperature may lead to the precipitation of various minerals on the metal surface. Frequently this is due to the decrease in solubility of some minerals in water with increase in temperature. In other words, when certain waters are heated, some minerals will deposit on the metal surfaces with which the water comes in contact. The most common scale, often found in heating coils such as in water heaters, evaporators, boilers, consists essentially of calcium carbonate, formed at elevated temperatures by the breakup of calcium bicarbonate. Since the calcium carbonate that forms is much less soluble than the original calcium bicarbonate, it slowly precipitates and, over a period of time, builds up a white, yellow, brown or gray colored mineral scale on the metal surface. Frequently, when this reaction occurs, considerable stifling of corrosion takes place. Specimens of copper-base alloys have been examined that were so well protected by carbonate or silicate scales ranging from 0.005 in. to 0.020 in. in thickness that they have resisted corrosion for generations.

Unfortunately, an excessively thick mineral scale on the inside of a water heater coil, boiler or evaporator tube, seriously interferes with heat transfer which results in higher temperatures on the metal surfaces facing the fire or products of combustion. Such conditions may result in failures from rapid oxidation of the metal or actual "burning."

Mineral Scales Formed in Sea Water

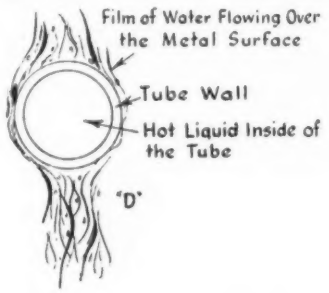
The formation of mineral scales is not limited to fresh water, but is frequently encountered in heat exchangers dealing with the evaporation of sea water as well as fresh water. Here, evaporation leads to the concentration of mineral matter to a point where precipitation occurs, resulting in the formation of thick, flint-like mineral scales on the heating coils. These films, which are generally grey to dark brown in color, may form at rates as high as .0625 inches per month or higher, depending upon the size of coil and the amount of water being evaporated. Steam heated copper coils are widely used for this purpose, and it is frequently necessary to take the coils from the unit in order to remove the layer of mineral matter. If reduction in life of the coil occurs it is due primarily



to the mechanical or chemical means used to remove the mineral scale.

Hot-wall Effect

Sometimes severe local corrosion or pitting can rapidly perforate water heater tubes on the water side because air bubbles separate from the water and cling to the metal surface at certain points, usually at scratches or sharp indentations, thus hin-



dering the water from cooling those spots. The combination of high local temperatures, high concentration of corrosive agent separating where the bubble forms and the quantity of dissolved gas accelerates corrosion at the point of bubble contact. Under these circumstances the rate of perforation of a heater tube increases considerably with an increase in tube wall temperature. Deposits of foreign matter (rust, other types of scales, etc.) may also permit a local high temperature to develop under the deposit. In Figures A and B, the effects of gas bubbles and deposits are shown in heat exchanger tubes where the heat is moving from the outside surface toward the inside surface of the tube. Frequently both the bubbles of gas and deposits of foreign material will separate from the corrosive liquid and result in the condition illustrated in figure C.

Corrosive cooling water passing through a metal tube with only a slightly corrosive hot liquid on the outside may fail prematurely. On the other hand, a tube of the same composition but with the hot liquid passing through the tube and cooling water flowing around the outside of the tube will have a normal life. In this instance the rapidly flowing water prevents both the formation of bubbles of gas and the deposition of certain types of foreign material. See Fig. D.

In laboratory hot-wall tests, non-ferrous and ferrous tubes failed quite rapidly when exposed to 3% sodium chloride solutions. In service, such failures are occasionally encountered on the liquid or water side of the tube. Water heaters with steam or flame on one side of the tubes illustrate the type of equipment where pitting most commonly occurs because of the "hot-wall effect."

The following preventive measures are suggested:

1. The temperature should not be higher than necessary.
2. Continued uninterrupted heating should be avoided.
3. Production of scratches on the metal surface or wiping may shift the point of bubble formation.
4. Gas, sediment, etc. should be removed from the water.
5. Increased water velocity or circulation will help to dislodge bubbles of gas and debris.

Technical Service

A number of condenser tube alloys are available which are designed to resist dezincification, air impingement, pitting and general thinning. If operators are not satisfied with the tube life they are now receiving, our Technical Service Department will submit samples for installation under actual operating conditions. Such tests have brought gratifying results and have led to the installation of condenser tube alloys such as Duronze IV (arsenical aluminum bronze), which have greatly increased the average tube life of seaboard condensers. This alloy is also highly recommended for marine operation. For conditions involving excessive impingement corrosion due to turbulence which cannot be corrected 70-30 cupro nickel has given very satisfactory results.

Condenser Tube Manual

Write for your copy of Bridgeport's 112-page Condenser Tube Manual which contains practical, up-to-date information about tube alloys; specifications; corrosion research data; methods of installing; suggestions for increasing tube life. There are 39 illustrations, 29 diagrams and 23 tables to help present this important information.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

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DART UNIONS

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Dam on Neosho River in northeastern O

Grand River for the past two years been under the jurisdiction, for po marketing purposes, of the Southwes Power Administration, an Interior D subsidiary which also markets power f Texas' Denison Dam and Arkansas' N fork Dam. Grand River belongs to Grand River Dam Authority, an Oklaho instrumentality, and must be turned b to the Grand River Dam Authority wi six months after the official end of war. Four 15,000-kw hydro turbines are Grand River and final unit is being bu

Interior Dept's interest in surplus po capacity arises from a statement by late President Roosevelt, who in Decem 1943, notified the Army, Navy and Defe Plant Corp, as owners of war-insta power plants, that, "I have in mind such plants may be utilized after the in connection with existing public po systems." SPA currently obtains st backup for its exclusively hydro capa from privately owned members of Southwest Power Pool, and acquisitio the 40,000 kw of steam to the north south of Grand River Dam should go toward freeing it of dependence on pri power. Of the 40,000 kw in the ordnance plants that are declared surp 10,000 kw are in high backpressure turb that require an outlet for process st before they can be used economically.

Surplus Property Act

Whatever attempts Interior Dept m make to obtain control of these or o generating plants would be bolstered the Surplus Property Act, which prov a top priority for government agencie the disposal of surplus property. It is priority which could come into conflict RFC's desire to sell surplus plants, inc ing power equipment, as a whole.

Power installations at plants recently clared surplus by the Army follow:

Kentucky Ordnance Works, Padu Ky., one 500-kw unit; Dixie Ordn Works, Monroe-Sterlington, La., two 75 units (*C*)†, three 750-kw units (*N*), 1500-kw unit (*C*) and one 2000-kw (*C*); Gopher Ordnance Works, Win Minn., one 300-kw unit (*NR*); Jayh Ordnance Works, Pittsburgh-Ba Springs, Kan., four 5000-kw units New River Ordnance Works, Pulaski- ford, Va., two 6000-kw units (*CP*) and 6000-kw units (*N*P*); Cactus Ordn Works, Etter-Dumas, Tex., five 200 units (R); Oklahoma Ordnance W Pryor, Okla., two 5000-kw units (*C*) two 5000-kw units (*N**); Ohio River nance Works, Henderson, Ky., three 3 kw units (*C*); Ozark Ordnance W Eldorado, Ark., eleven 1000-kw units and two 1500-kw units (*N**); Phi Petroleum Co, Borger, Tex., eigh 1000-kw units (*G*); Plumbrook Ordn Works, Sandusky, Ohio, two 1000-kw u Missouri Ordnance Works, Louisiana, three 7500-kw units (*C*); Keystone nance Works, Meadville-Geneva, Pa., 1500-kw unit.

† Letters in parentheses after each unit sta following: *C* for condensing, *G* for gas engi for non-condensing, *P* for integral part of facturer's plant, *R* for reciprocating and high-backpressure units.

(*Continued on page* 190)

ONE *recognized standard*

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(*Advertisement*)

BULLETIN!

How to Take a Reconversion Inventory of Your Electric Motors

☛ As new manufacturing equipment becomes more widely available, and as you reconvert your production toward a peacetime basis, you may be faced with an unprecedented problem of inventory-taking.

☛ You may have to determine — more quickly than such a job has ever been done before — the exact condition of every piece of existing equipment you propose to use in peacetime production.

☛ For about four years, far greater emphasis has been placed on setting production records than on keeping maintenance records; condition of equipment is often unknown. Because much equipment has been worked during wartime three and four times as many hours a year as in peacetime, calendar age may mean nothing. And repair has often depended on American ingenuity and baling wire.

☛ Here are some of the standards you need to determine which of your electric motors: (1) are okay as is, (2) need repair or new parts, (3) will shortly require replacement, (4) need reapplication.

☛ These standards generally apply to all makes of motors; when in doubt on any motor, consult its manufacturer.

1 START YOUR INVENTORY WITH THE RECORDS

Begin your motor inventory with the history of each motor; you'll save much time and effort... you'll be guided quickly to the units which most need attention. Written records and the mental recollection of foremen and maintenance men are the source of this information.

Check the *master maintenance records* (though in most plants this file is out-of-date and incomplete, because of wartime pressure on production); and get *reports from foremen* (in a small plant, it may be possible to interview each man; in a large plant, it may be more efficient to distribute blank forms, such as the "MOTOR CHECK LIST" on opposite page.)

Look into the service to which the motor has been subjected in wartime: has it been overloaded? underloaded? worked 3 shifts daily? allowed to go to work in spray, steam, flood, acids? has it had mechanical injury? has it stood idle, collecting moisture and dirt?

Knowing the answers to these questions will help you spot motors that may soon give you trouble... you can start your inventory there.

NOTE: All new motors built during wartime, under WPB limitation orders, contain minimum amounts of critical materials. Thus, unlike many prewar motors, they have been incapable of withstanding continued overload operation in the way you've come to expect high-grade American motors to do. Moreover, you've had to take motors at the ratings you could get, without much regard to the exact requirements of the application. Thus, many motors have been running harder and at higher temperatures than nameplate ratings call for. Obvious result of this combination of factors is shortened insulation life. So—*expect* trouble where wartime motors are misapplied.

2 THEN CHECK MOTORS IN OPERATION

Obviously, the easiest and most practical measure of a motor's present condition is the way it is now operating. You can't learn all you need to know about its probable future performance by observing it in use, but a motor does reveal certain symptoms of trouble while doing its job.

Check the power line voltage and frequency and compare with the voltage and frequency of the motor as stated on the nameplate. To perform properly, a motor must be supplied from a line whose characteristics correspond with those for which the motor was designed.

Check rpm — hand revolution counter makes this easy. Just remove cap, hold counter against end of shaft and take a timed reading; compare with nameplate rating.

Take temperature readings — not by the "blistered hand" or "touch and yell" system, but *accurately*, with *thermometers.*

Find the temperature of the *motor* by taping or cementing thermometer to the stator iron... take the reading and add 15°C. (The difference between the heat on the outside surface and the possible heat of the hottest part inside).

Compare motor temperature with temperature rise rating on the nameplate. Normally a 40° rise is considered acceptable; top temperature usually should not exceed 80°C.

Take the temperature of *bearings*

either by taping or cementing thermometer to the bearing housing, or by inserting it into the oil well. In general, maximum safe bearing temperature is 96°C. (Bronze bearings may take somewhat higher temperature safely. When in doubt, consult motor manufacturer.)

Listen for — EXCESSIVE HUM. May be caused by uneven air gap, and may call for replacement of bearings. Or it may be caused by loose laminations or unbalanced rotor. Note this hum while inspecting motor in operation; check for cause later, while making inspection of parts.

Note — VIBRATION. If excessive, this may be caused by either misalignment between shafts of motor and driven machine, or through transmission of vibration in driven machine to the motor. Run motor disconnected for check. *If vibration follows motor repair,* it's probably due to out-of-balance rotor.

Listen for — RAPID KNOCKING. May be caused by misalignment, with shoulder of shaft pounding against bearing end; realign set . . . and note this knock, check bearings when making inspection of parts.

NOTE: if excessive vibration, knock, or squeal follows re-assembly of motor, cause may be incorrect axial adjustment for float.

Look for — EXCESSIVE SPARKING OF BRUSHES. Check for cause when motor is taken down for inspection.

3 THEN CHECK THE PARTS

If time permits, you'll want to give detailed inspection to *every* motor that's been in strenuous service these past years. (You may be able to work this into your regular production schedule. Set up a system so that the electrical department may be notified whenever a machine is to be down. Disassembly and inspection of motors can be done then.)

And in cases where *history* of the motor or its *operating characteristics* indicate the likelihood of present or future trouble, you'll surely want to take a close look at the parts themselves.

A. FIRST — disconnect motor leads and uncouple motor from driven unit.

B. THEN — if excessive hum was noted while motor was in operation, use feeler gauge to check air gaps between rotor and stator. Difference of more than 20% indicates overworn bearings, sleeves, or journals. Check bearings as indicated below.

C. REMOVE end housing and lift rotor out, using a sling if rotor weighs over 75 pounds. If rotor is dirty, clean it with air hose (pressure not over 30 lbs), bellows, or vacuum cleaner, or swab it with non-inflammable solvent.

D. INSPECT rotor for abrasion; corrosion; discoloration (caused by overheating.) In squirrel cage motor, check also for loose or broken rotor bars.

E. IF ROTOR or armature is the wound type, check for loose banding. If any looseness is noted, band with new wire before putting motor back in service. If band assembly has not failed extensively — perhaps only a solder failure at one or two clips — repair can usually be effected simply by resoldering. Major rebanding, however, is a job for experts.

F. CHECK INSULATION — As motors get older, or as they operate continuously at high temperatures, insulation on coils tends to become brittle. It may start flaking off, cutting its insulating value. This may not affect motor performance seriously *except* that it may lead to short circuits or grounds, excessive vibration (out-of-balance rotor), or clogging of the air vents (leading to overheating) or abrasive wear from fallen particles. SO — check insulation visually . . . see whether pieces of insulation have torn or flaked off . . . and also make a megger (megohmeter) test. For a clean, dry motor at 75°C, insulation resistance in megohms, according to the American Standards Association, may be found by the formula:

$$\frac{\text{Rated voltage of motor}}{\frac{\text{Rating in KVA}}{100} + 1000} = \text{Insulation Resistance in Megohms}$$

G. CHECK BEARINGS — to remove ball bearings, use a puller, applying pressure to the inner race only, maintaining uniform pull all around, to avoid distorting the bore of the race.

Check bearings for excessive wear, scoring, or pitting.

To examine *anti-friction bearings,* first clean them thoroughly with kerosene to remove all old grease and dirt particles; then hold inner race and rotate outer race, feeling for roughness of action and listening for noise.

Inspect sleeve bearing clearance with feeler gauge. Normal clearances may be computed this way: take 0.003" as the basic tolerance . . . then add 0.001" for each inch of shaft journal diameter. Inspect journal surfaces; if scoring seems excessive, consider replacing.

If bearing shows no excessive wear, the hum of the motor in action may result from out-of-balance rotor or armature. Check this on parallel bars.

H. CHECK for cause of sparking. Check mechanical condition of parts. (For details, see Reconversion Inventory Kit, offered below.)

4 NOW MAKE THE APPRAISAL

With all the facts in hand — history, operating characteristics, condition of parts — your electrical department will be best prepared to assign this motor to its new role in reconverted production. Use check list forms like this —

RECONVERSION INVENTORY CHECK LIST FOR ELECTRIC MOTORS

for easy inspecting and appraising. Your nearby Allis-Chalmers district office or distributor will supply free copies of this Check List in whatever quantity you require.

CENTRIFUGAL PUMPS, V-BELT DRIVES, NEED INVENTORY TOO!

To speed your Reconversion Inventory of the most common industrial units, Allis-Chalmers has prepared a Reconversion Inventory Kit covering Electric Motors, Centrifugal Pumps, and V-Belt Drives. No big package, this kit is simply a set of Fact Sheets and Check Lists covering each type of unit, with suggestions for inventory procedure as outlined in these pages, but in somewhat greater detail.

A 1901

GET THESE FREE FORMS

For your supply of Reconversion Inventory Kits, covering motors, pumps, and v-belt drives, call your nearest Allis-Chalmers district office or distributor or write Dept. 412, ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

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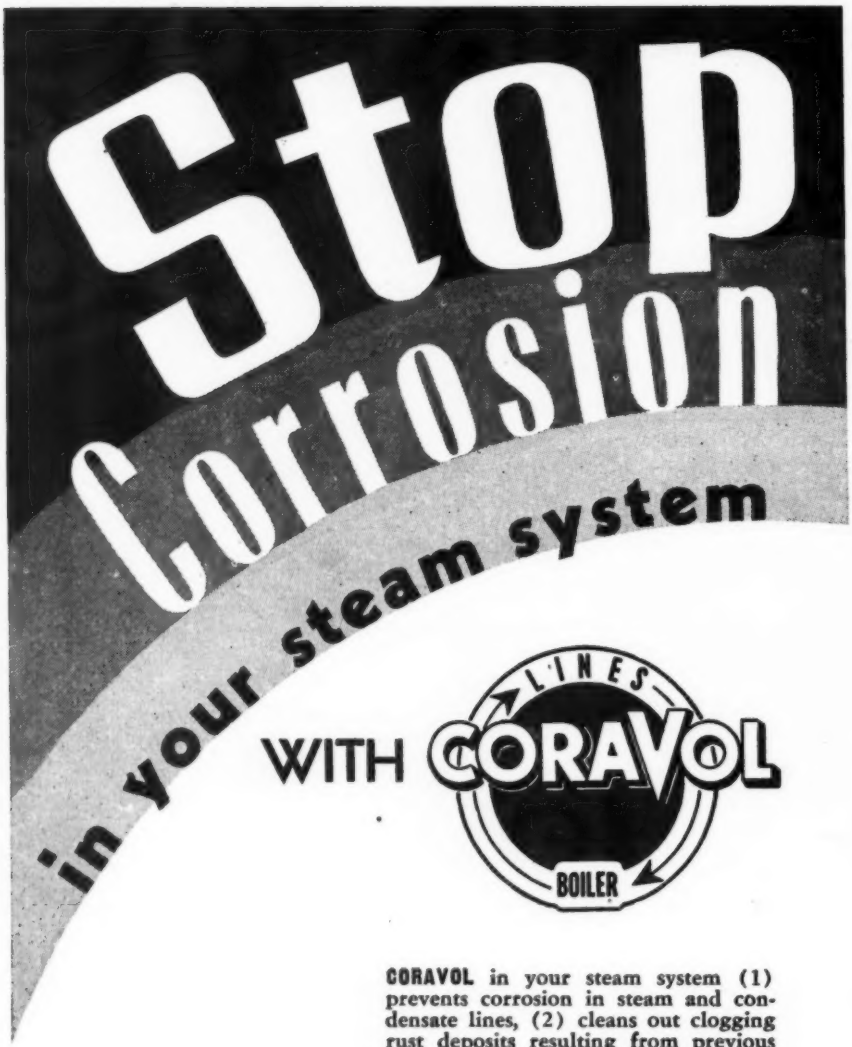

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OWU Executives Return To Civilian Positions

Edward Falck, former director of Office of War Utilities, which wound up its war job and went out of business Sept. 30, is opening a utility and industrial consulting firm this month. He will have offices in New York and Washington, D. C. The organization will specialize in management and public relations for electric and gas utilities and will serve industrial clients.

Playing a major part in the development and administration of the war utility program since before Pearl Harbor, Edward Falck was one of the oldest officials, in point of service, in the Government war agencies. He has headed the OWU for the last 17 months, and before that had been its deputy director since its creation. He was largely responsible for the power rationing program worked out for the Southeastern curtailment late in 1941, out of which grew Order L-94 and the comparable orders covering gas utilities, U-7 and L-174.

In addition to directing the domestic war utility program, Falck had direct charge of the OWU work assisting the Army in planning installation of equipment in occupied and recaptured countries. He was chairman of the Public Utilities Committee of the Combined Production and Resources Board and chairman of the utilities subcommittee of the Technical Industrial Disarmament Committee, charged with recommending the policy for post-surrender treatment of the German power industry. Under his direction, OWU sponsored a team of utility technicians which went to Germany last spring in search of German "know how" which might be of value to American utility manufacturers and operators.

Changes in Position

For more than a year during development and early administration of the Controlled Materials Plan, Falck also was assistant WPB priorities director under J A Krug, first OWU director, now WPB chairman.

Falck came to Washington from the position of assistant to John C. Parker, vice-president of Consolidated Edison Co, to help Krug organize the Power Branch in the old Office of Production Management in 1941. Before joining Consolidated Edison, Falck had been director of rates and research for Tennessee Valley Authority.

V M Marquis, former head of OWU's Power Div since the first of the year, left the organization soon after Sept 1 to become associated with Pacific Gas & Electric Co in a capacity as yet undisclosed. Marquis joined the Power Branch of the old Supply, Priorities and Allocations Board in Jan, 1942, as a "dollar-a-year" man on loan from the American Gas & Electric Service Corp. He was western power supply engineer until last Jan, when he resigned from AG&E to replace Barclay J Sickler as head of the Power Div, a position he held until he left.

J E Moore, deputy director of the Power Div and the senior member of OWU in point of service, returned to Ebasco Services, Inc, in Sept. Moore joined J A Krug, then chief of the newly organized Power Branch of the Office of Production Manage-

(*Continued on page* 194)

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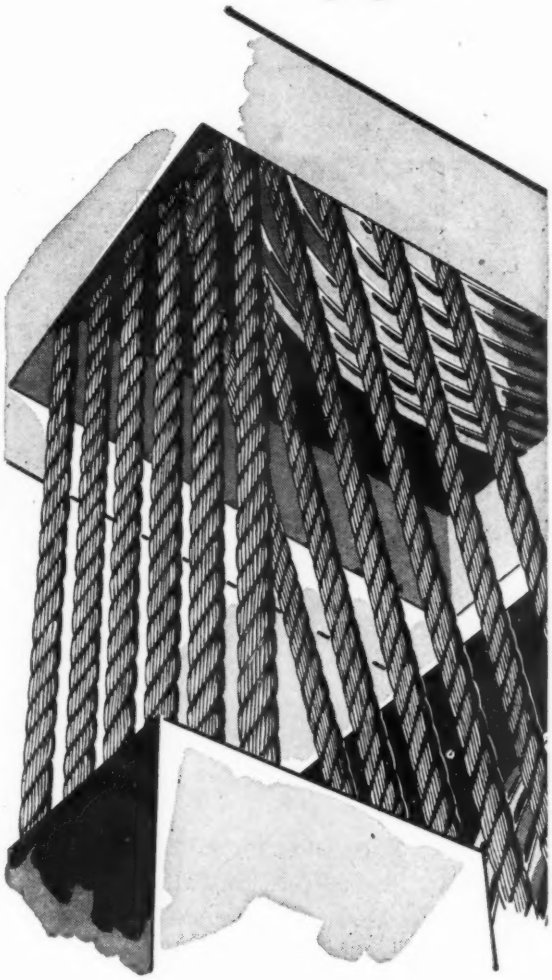


NO TIME LIKE NOW to check over your equipment's readiness . . . for the big peace-time job ahead. And in checking your elevator ropes, include these points:

Are sheaves and drums regularly checked for excessive wear that would injure the rope operating over them? Does the rope get proper handling, lubrication, inspection, maintenance? Is it Roebling Special "Traction Steel" Elevator Rope?

If the answers are "yes", bank on *safe*, long-lasting, economical rope service . . . for today's toughest, tomorrow's biggest jobs. That's because this rope is made to combine smooth-running flexibility with high fatigue resistance.

It's the result of fine Roebling steel, exceptional equipment, a century-old tradition of sound workmanship. And whether *your* rope problem is one of selection, operation or maintenance, Roebling engineering service can help you solve it . . . to your advantage.

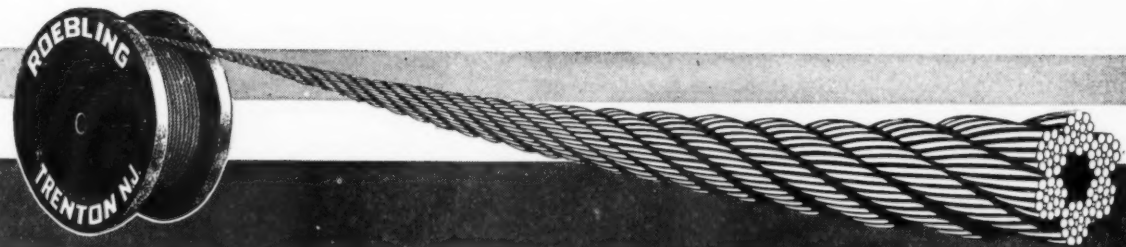
As government needs taper off, Roebling wire rope will again be available to non-priority users, in order of precedence.

JOHN A. ROEBLING'S SONS COMPANY

TRENTON 2, NEW JERSEY

Branches and Warehouses in Principal Cities

WIRE ROPE AND STRAND • FITTINGS • SLINGS • COLD ROLLED STRIP • AERIAL WIRE ROPE SYSTEMS • ROUND AND SHAPED WIRE • SUSPENSION BRIDGES AND CABLES WIRE CLOTH AND NETTING • ELECTRICAL WIRES AND CABLES • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES



ROEBLING

ACEMAKER IN WIRE PRODUCTS

Dry coal or wet

small sizes or large

screened or run-of-mine

. . . it is all the same, with the Hagan Differential Master method of Automatic Combustion Control.

Many automatic combustion control systems for pulverized fuel fired boilers use the coal feeder as a coal flow meter. Since the dependability of the fuel feed apparatus as a meter is affected by variations in coal size and moisture content, undesired variations in excess air occur in the boiler furnace.

Previous attempts by others to eliminate these undesirable variations involved the use of correcting mechanisms which had to be limited in speed of operation or extent of correction in order to even approach stable control. By the use of a unique arrangement of standard Hagan apparatus, variations in excess air from this cause are eliminated *without limiting the range of control or reducing speed of operation.*

The method employed is simple. A Hagan Master Sender, sensitive to steam header pressure, controls heat input in accordance with demand. A Hagan Differential Master Sender, measuring steam flow, regulates air flow. The rate of fuel feed is changed instantly by the Master steam pressure regulator to compensate for any variation in feeder characteristics, *but air is not changed unless there is an actual change in boiler load.*

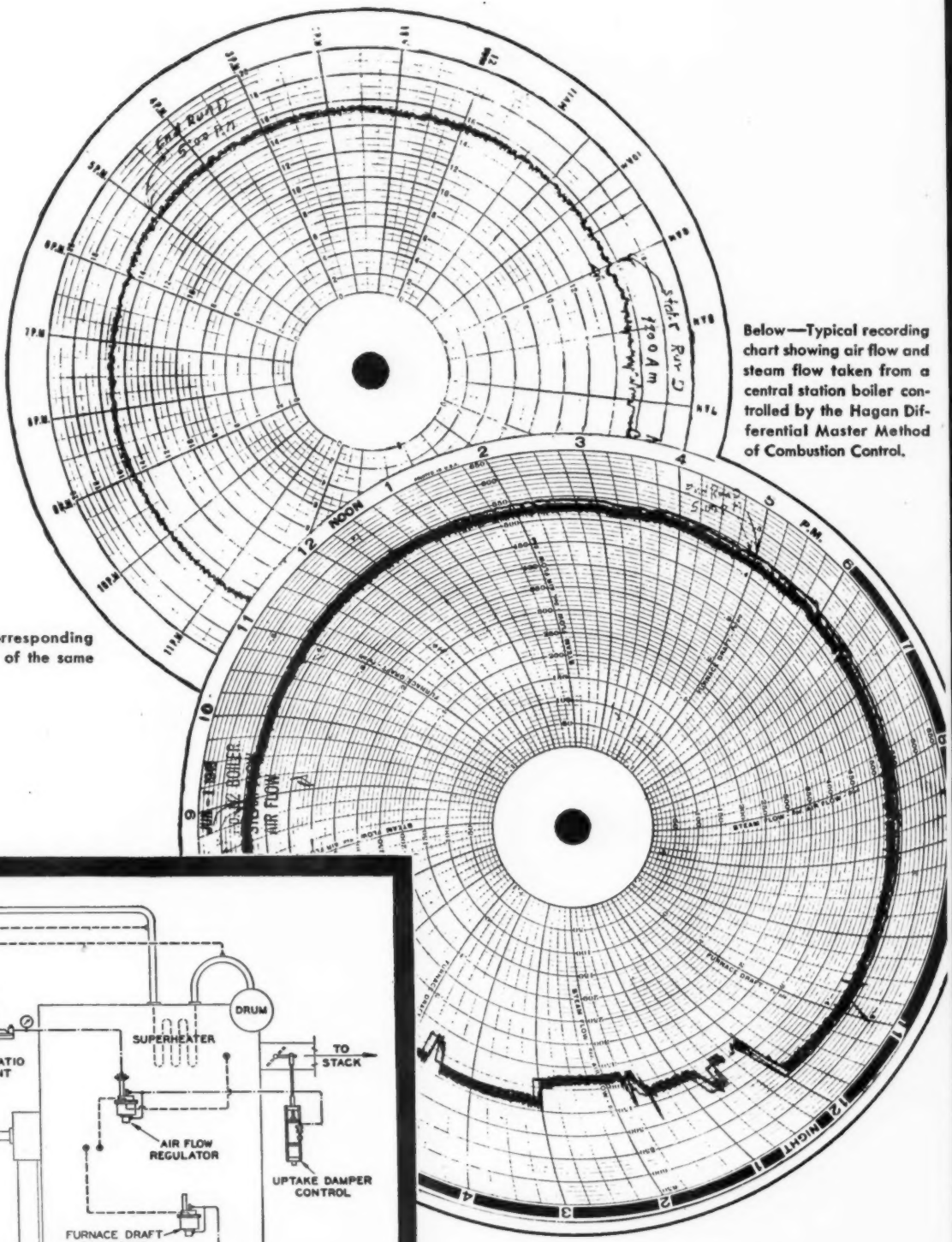
With this system of combustion control compensation for erratic coal feed is instant and accurate—by controlling directly and accurately there is no necessity for approximate adjustments, to be corrected later by a lagging corrector.

The ability to achieve such results stems from the inherent speed, sensitivity and stability of Hagan Control apparatus.

Write for full information.

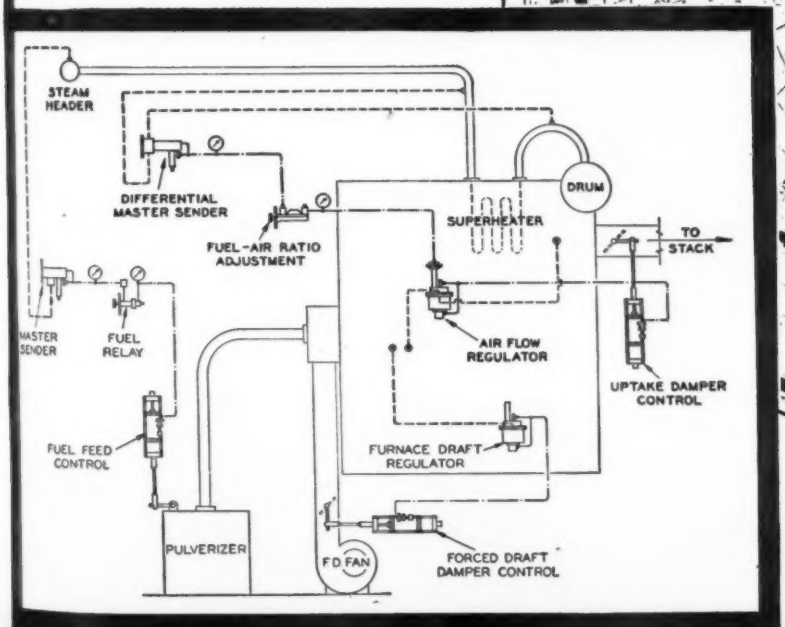
HAGAN CORPORATION, Hagan Building, Pittsburgh 30, Pa.

HAGA
HALI
BURON
CALG



Below—Typical recording chart showing air flow and steam flow taken from a central station boiler controlled by the Hagan Differential Master Method of Combustion Control.

Above — Corresponding CO_2 Record of the same day.

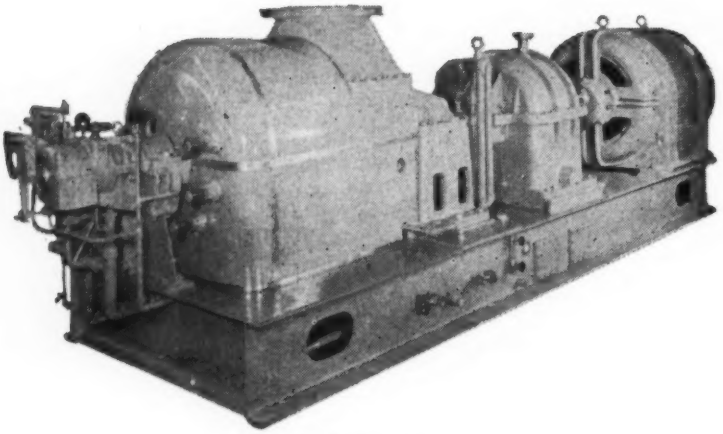


Basic arrangement of the Hagan Differential Master Control system applied to pulverized coal-fired boiler.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

MURRAY
TURBINE GENERATORS



500 KW—PACKAGE TYPE

The unit shown above was designed to deliver 500 KW 50 cycles alternating current on steam at 285# gauge, 700 degrees F., an exhausting condensing to 27 inches vacuum. Thirty identical units were furnished.

Equipment included trip and throttle valve, oil relay governor controlling single throttling inlet valve with hand valve control for partial load operation, all service connections above floor line except generator leads, drain piping brought to one point, and structural steel baseplate. The baseplate is sufficiently rigid so that the unit can be handled in one piece, and installed on the simplest of foundations.

While "Package Type" units are furnished for export for installation in remote areas not previously supplied with power, similar designs can be made for industrial plants for main or standby power supply.

MURRAY *also produces:*

Mechanical drive turbines, horizontal and vertical
Reduction Gears — Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

ment, in June, 1941, and was the second man in the organization. Starting as general consultant, he later became head of the Production Section and headed the Power Supply Section from the time of its organization. He became deputy director of the Power Div last Jan.

C W Jones, former chief of the Equipment Production Branch of the Power Div, returned to the New England Power Assn in Sept. Jones joined the organization early in its history and served for more than two years, returning to the New England Power Assn early this year. He returned to take over the Equipment Production Branch last June when its former head, Lester Bosch, went to China on a government mission.

Dr Herschel F Jones, former assistant to Falck, joined the Bonneville Power Administration as assistant to B J Sickler, head of the div of Power Sales and Services. Sickler had been head of the Power Branch from the organization of OWU until last Jan. Jones joined OWU as assistant to Falck a year ago after two years with WPB in its Office of Civilian Requirements.

DEMA Issues First Copy Of Diesel Booklet Series

Growing demand for diesel engines for producing power in municipally owned plants is revealed in a new booklet published by Diesel Engine Manufacturers Assn, 1 N La Salle St, Chicago 2, Ill. Covering diesels in city power plants, the booklet is the first of a series to be issued by the assn under the general title, *Diesel Facts.*

Prior to 1910, comparatively few diesels were used to generate current in municipally owned power plants. Ten years later, 33 million kwhr were being generated by diesel engines in such plants. By 1930 the figure was 250 million kwhr and in 1943 it had increased to nearly two billion.

The diesel's operating economy and reliability are cited as the chief reasons for its growing popularity in this service. Other advantages are simplicity and compactness of a diesel power plant, its cleanliness and the minimum of attention required for its operation.

A special section of the booklet treats of the procedure to be followed by a city that wants to have its own power plant. Another section outlines the widespread use of diesel engines in generating projects of Rural Electrification Administration.

A survey of potential peacetime uses of diesel engines has been made by the assn. During the war, the government had been using practically all of the diesel-engine output for propulsion in ships and boats and for electric-generating sets to be sent overseas. The industry will now naturally turn to its prewar markets. The first of these markets to be explored by the assn is the field of municipal light and power plants.

Future booklets to be issued by the Diesel Engine Manufacturers Assn will deal with diesel-engine applications in marine, locomotive, oil-industry and stationary fields.

(*Continued on page* 198)

GRAPHITE GUS SAYS:

IT'S A JOB FOR GRAPHITE

to prevent failure of ordinary oil and grease

Use DIXON'S Lubricating Graphite on the tough spots. Rub it on dry. Add it to your regular oils and greases.

Dixon's Ticonderoga Lubricating Flake Graphite. Sleeky, large flakes or medium powdered, this graphite gives sustained friction freeing lubrication on packings, large free-fitting bearings, open gears, sprockets, chains and other heavy duty equipment. Add it to oils and greases to fortify them against extremes of temperatures, and pressures. It lengthens lubricant life. Data Sheet #5 tells where and how.

Dixon's No. 635 Lubricating Flake Graphite. This finely powdered graphite is particularly suitable for close-fitting bearing surfaces and mechanisms operating under high temperatures, pressures and speeds. It is extremely unctuous and is used dry. Added to oils and greases it lengthens their life and makes better friction fighters. Data Sheet #6 illustrates uses.

Dixon's Microfyne Lubricating Flake Graphite. Being microscopic in particle size, this lubricating flake graphite is especially processed to meet the largest variety of applications. As a co-lubricant in plain oils and greases it enables them to stand up under conditions of extreme heat, cold, speeds and pressures. Used dry it quickly establishes a friction-free surface. Data Sheet #7 shows other uses.

Dixon's Graph-Air Gun, Type 4. Handily blows its contents of dry Microfyne Graphite into locks and all close-fitting mechanisms. Provides long lasting lubrication that's exceptionally resistant to conditions that destroy ordinary lubricants. This powdered graphite will not gum or dry out. In plant, office, home, Dixon's Graph-Air Gun is the most useful lubricator ever. Data Sheet #8 lists many of its 1001 uses. Get your gun at Supply or hardware store—30¢.

DIXON'S GRAPHITES
in LUBRICATION - HEAT CONDUCTION
HEAT and COLD RESISTANCE - ELECTRICAL CONDUCTION
PROTECTIVE COATINGS and PAINTS

ANSWERS!
HELPS! HINTS!

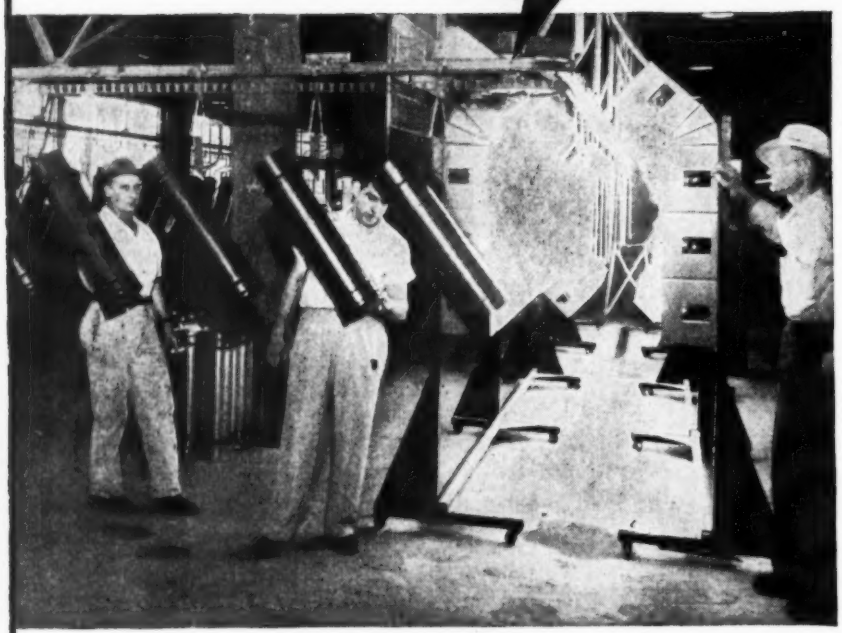
For help in a tough lubrication problem, Write Graphite Gus for illustrated Data Sheets on the product or products that interest you. They tell how and where you can make Graphite do the job—Better.

JOSEPH DIXON CRUCIBLE COMPANY

DIV. 94C10 JERSEY CITY 3, NEW JERSEY

OVER 4000 PLANTS HAVE CONVERTED TO—

INFRARED for *More and Better*



A Typical Installation

SHELL CASE FINISH BAKED IN 9 MINUTES

Fostoria Evenray equipment is being used extensively for baking shell and cartridge case finishes. Pictured, to the left, is an installation for baking the protective coat on M-13 cartridge cases.

Baking time of only 9 minutes indicates the high efficiency production and cost saving with Fostoria equipment. This wartime installation will be equally useful for peacetime operations.

Be sure to investigate the similar advantages of Infrared for your operations.

Throughout industry, new high standards of production efficiency are being set by the utilization of Infrared Energy for baking, drying, dehydrating and preheating. Cost savings of 50% and more are common. Such advantages as *greatly increased production per man hour, less floor space needs, fewer rejects, no stand-by loss, and more worker comfort* are but a few of the proven benefits available in the Fostoria Evenray System.

Some of the many varied operations for which Fostoria equipment is now being employed include the *baking* of lacquer, paint and varnish finishes, acetate and zinc chromate coatings, armature insulation, asphalt binders, etc.; *drying* latex, glue, ink, glazing, sand molds, waterproofing, wet motors, etc.; *preheating* plastics, metal fittings, wax, oil, glass, resins, etc.; *dehydrating* textiles, chemicals, paper, plaster, clay, foods, etc.

Call one of the Fostoria Industrial Service Centers, listed below, for detailed information on Infrared advantages for your particular operations.

FOSTORIA INDUSTRIAL

Specialists in the Application of Near Infrared

THE FOSTORIA INDUSTRIAL SERVICE FORMULA FOR APPLYING INFRARED ENERGY

Study of problem and pretesting for solution

+

Calculation of installation required

+

Supervision of Installation

+

Baking • Drying • Dehydrating • Preheating

Production - Faster at Lower Cost

Fostoria Evenray Equipment Provides Highest Efficiency and Adaptability in the Utilization of Infrared Energy

HIGHEST RADIATION EFFICIENCY

Fostoria Evenray equipment, utilizing technically designed gold plated reflectors and clear glass Infrared lamps, is superior to any other equipment in useful radiation efficiency. Actual tests prove 20% higher efficiency as compared to reflector type lamps alone.

UNEQUALLED UNIFORMITY OF COVERAGE

Fostoria Evenray equipment provides an almost perfect uniformity of heat pattern—less than 2% radiant variation. No other equipment approaches this uniformity, even when lamps are staggered.

GREATER PERPENDICULAR COVERAGE

The Fostoria Evenray reflector, designed with wide cut-off angle, produces a higher percentage of radiation radially. Perpendicular coverage is approximately the same as parallel coverage, thus, equalizing the intensity of radiation on all surfaces of any article being processed.

WIDER RANGE OF LAMP SIZE

The Fostoria Evenray reflector provides adjustability to house all commercially available Infrared lamps from 85 watts to 1000 watts.

IDEAL MECHANICAL CONSTRUCTION

Fostoria Evenray equipment is designed for assembly to contour and length as required for work of any size or mass, and for any material handling method. Ovens as assembled are fully enclosed.

EASY ALTERATION

The construction of Fostoria Evenray equipment permits full reutilization when alterations are desired for new or changed production needs.

REQUEST THIS FREE BOOKLET, TODAY

Includes fundamental information about Infrared and the advantages of Fostoria Evenray Systems.

Technical information applicable to your operations will be included if you send us general facts about your baking, drying, dehydrating or preheating problem.

Catalog of standard portable equipment also available on request.

FOR COMPLETE ENGINEERING SERVICE

Fostoria Industrial Service is nationwide. This organization of Infrared specialists offers the experience of over 4,000 highly successful installations. It provides the comprehensive technical facilities necessary to pretest and forecast accurately the benefits of Infrared for your specific use.

Highest Efficiency in the Utilization of INFRARED RADIANT ENERGY

EVENRAY SYSTEM

fostoria

FOR BAKING • DRYING • PREHEATING • DEHYDRATING

Trade Mark Reg U S Pat Off

SERVICE

Radiant Energy

= SUCCESSFUL OPERATION

After-installation service

THE FOSTORIA PRESSED STEEL CORPORATION • FOSTORIA, OHIO

Independently Affiliated Manufacturers
Southern Industries, Atlanta, Ga.
Amalgamated Electric Corp., Ltd., Toronto, Canada

Export Sales Dept.
401 Broadway
New York City

LOCATIONS OF FOSTORIA INDUSTRIAL SERVICE CENTERS

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Main 2757

BOSTON
620 Commonwealth Ave.
Commonwealth 0333

BUFFALO
725 Main St.
CL 8336

CHATTANOOGA
1021 Chestnut St.
Phone 6-6194

CHICAGO
747 W. Jackson Blvd.
Randolph 5942

CLEVELAND
4500 Euclid Ave.
Endicott 6622

DAYTON
334 Wayne St.
Fulton 3594

DETROIT
12171 Grand River Ave.
Hogarth 1850

INDIANAPOLIS
548 Massachusetts Ave.
Riley 2934

LOS ANGELES
1206 Maple Ave.
Prospect 7761

MILWAUKEE
104 East Mason St.
Daly 2949

MINNEAPOLIS
2 Foshay Tower
Atlantic 7363

NEW HAVEN
(Hamden, Conn.)
1240 Whitney Ave.
Phone 2-5985

NEW YORK
92 Warren St.
Worth 2-3352

OAKLAND
205 Twelfth St.
Twin Oaks 4475

OMAHA
1102 Farnam St.
Atlantic 5540

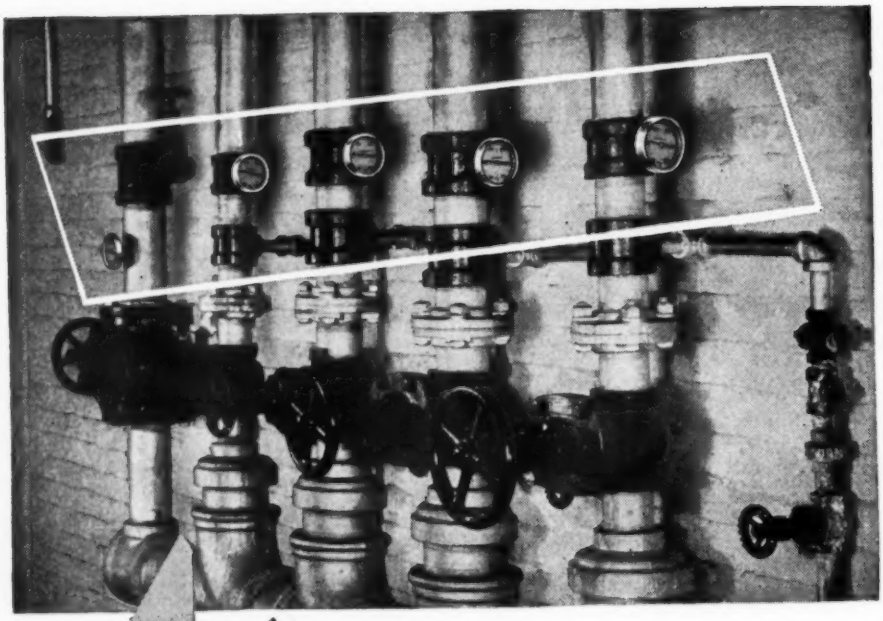
PHILADELPHIA
(Bala-Cynwd, Pa.)
349 Montgomery Ave.
Greenwood 4477

PITTSBURGH
5339 Penn Ave.
Highland 9900

ST. LOUIS
1706 Olive St.
Central 0153

SEATTLE
90 Dearborn St.
Main 0919

CANADA: Montreal • Toronto
Northern Electric Co., Ltd.

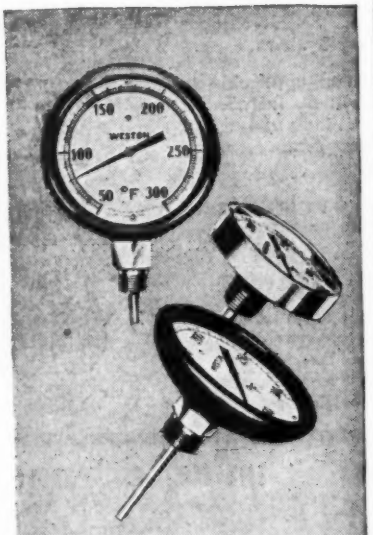


4 Temperature Readings... at one glance!

WITH READABLE, RELIABLE
WESTON *ALL METAL* THERMOMETERS

Readability does it... whether its single or multiple temperature readings... in dark corners, in hard-to-get-at places, or spots high overhead... Weston All-Metal Industrial Thermometers are "kind to the eyes". Their bold, gauge-type scales are quickly and accurately read, even a distance away.

And for accuracy and all-round ruggedness, too, you can depend on their sturdy, yet simple, all-metal construction. The only moving part is the all-metal temperature element—and that is safely enclosed in a stainless steel stem. Thus the high initial accuracy of the WESTON thermometer... within 1% over the entire scale... is maintained over long periods; despite shock, vibration or other severe usage. Literature gladly sent on request... Weston Electrical Instrument Corporation, 679 Frelinghuysen Ave., Newark 5, N. J.



Available in stem lengths from 2½" to 48" . . . ranges from + 1000° F to — 100° F ... scale lengths 6", 9", 12".

Weston *All Metal* THERMOMETERS

Industrial Concern Builds Turbine Test Laboratory

Construction of a new $750,000 test laboratory and extension of facilities of the research engineering div have been announced by Elliott Co. Plans for extensive research and development of gas-turbine power plants have called for construction of a new main building and several small buildings. Construction, which has already started, is expected to be completed within six months. Laboratory will be located adjacent to main factory at Jeannette, Pa. Among the permanent installations will be test stands for gas turbines, compressors and blowers, heat-transfer equipment, a combustion laboratory, a metallurgical laboratory and an experimental machine shop.

The gas-turbine test stand will test many sizes of gas turbines. The power source will be a combustion chamber capable of providing 12,500 cfm of compressed air up to 35 psig and up to 1500 F. Test stand will be equipped with a permanent foundation for mounting turbines and a special, electronically controlled, eddy-current, dynamic power-absorption brake.

The test stand for compressors and blowers will be operated by a 2500-hp steam turbine for driving in either direction, with a permanently mounted complete surface condenser and all auxiliaries, arranged so that hp input to the steam turbine can be accurately measured. A strain-gage torque meter will be part of equipment. This stand will also include a series of measuring orifices to measure any anticipated air flow up to 30,000 cfm.

Laboratory Is Completed

A stand, for testing of air-to-air heat-transfer equipment for high-temperature studies on extended surface units, will obtain its hot air from the same combustion chamber used to supply the gas-turbine test stand. Cold air up to 10,000 cfm will be supplied by a separate blower.

A combustion laboratory for design development and testing of combustion chambers using heavy oils and powdered coal will also take its air supply from the turbine test stand. In addition to equipment for coal weighing and pulverizing, the laboratory will be complete with all necessary measuring devices for temperature, pressure and flow quantities. For development work with gasoline for small turbines, a separate test building will be erected apart from main building.

A wind tunnel for aerodynamic testing of turbine blades, as well as compressor blades and other air-flow sections, will have a capacity of 10,000 cfm and will be capable of producing velocities approaching the speed of sound. Its air will be supplied by a separate blower.

A metallurgical laboratory for testing all properties of high-temperature metals will have, in addition to standard equipment, normal temperature fatigue testing machines, photo-microscopic equipment, a 120,000-lb tensile testing machine, etc.

Housed in a separate building, as part of the test laboratory, will be an experimental machine shop for research and improvement of machinery and methods.

did you ever see DIRT before?

THIS is what it looks like, magnified 100 times. Sharp flint-like, often germ-laden.

Unfortunately, your products, machinery, merchandise or even customers and workers find dirt harmful—and without the help of a microscope.

Wherever people, machinery, materials and processes are exposed to air, they are subject to the effects of air-borne dirt—infection, abrasion, contamination and the like.

Separating dirt from air is the job on which Air-Maze has specialized for nearly 20 years. Take advantage of this experience. Send your problems to us, or consult the yellow pages of your telephone directory for your nearest Air-Maze representative. Air-Maze Corporation, Cleveland 5, Ohio. *Representatives in principal cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.*

IF IT USES AIR . . . USE
AIR-MAZE
ENGINEERED AIR FILTRATION
• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers
• Exhaust spark arresters • Gear case, crankcase and tank vent breathers
• Oil-separators for engine crankcases • Full-flow type cleanable oil filters

"The seat assembly is the heart of the valve. I'd design it for dependability!"

Right! That's why have: LUDLOW STEEL GLOBE VALVES

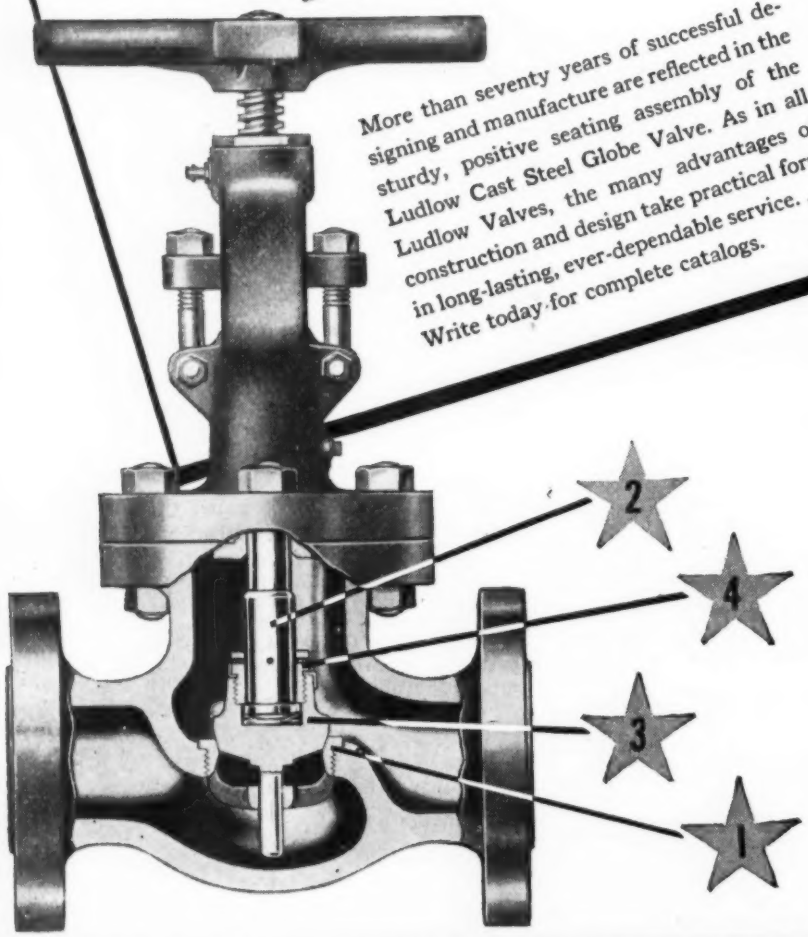
1. A variety of disc and seat ring materials for positive seating under any service.

2. Increased safety-factor through a larger stem-diameter in unsupported section.

3. A hardened steel disc, to take thrust of stem and prevent seizing.

4. A disc readily secured to stem, to simplify regrinding.

More than seventy years of successful designing and manufacture are reflected in the sturdy, positive seating assembly of the Ludlow Cast Steel Globe Valve. As in all Ludlow Valves, the many advantages of construction and design take practical form in long-lasting, ever-dependable service. . . . Write today for complete catalogs. G-5



The LUDLOW VALVE SINCE 1866
MFG·CO·INC·TROY·N·Y·

Eastern Coal Shortage Continues After V-J Day

Solid Fuels Administrator Ickes warned the public recently that the coal shortage was not automatically solved by the Japanese capitulation, asserting that during the coal year ending next March 31, coal needs will be difficult to meet.

Ickes' position was not wholly supported by the figures he released on demands and anticipated output, but he warned of failure to order low-grade coals with the statement:

"It is unfortunate, indeed, that misinterpretation of Gen B B Somervell's recent statement has caused the public to believe, erroneously, that there will be plenty of coal of all kinds because of the cancellation of war contracts, As a result, certain industries are failing to purchase the lower grades of coals and we shall not be able to replace the production thus lost. I want to free such consumers of their false optimism before irreparable harm is done to the coal supply."

An Office of War Utilities spokesman declared that whatever the situation may be in regard to lower-grade coals, the special purpose coals of Districts 7 and 8 almost certainly will not be easily available.

Somervell's Army Service Forces released a statement shortly after the Jap surrender offer indicating the cutbacks would free 145,000,000 tons of coal, but the figure proved to have made no provision for reconversion activities that would use coal.

Coal Output

Ickes said that detailed figures compiled by the Solid Fuels Administration indicate that the output during the present coal year, which would be required to meet all needs, ranges from 570,000,000 to 585,000,000 tons of bituminous coal. As yet, there is no indication that the mining industry will be able to obtain sufficient additional men to push its output beyond the 575,000,000 tons it is estimated can be produced this year if peak output with the existing labor force can be obtained. Variables in the amount of coal, which may be exported and in that which may be furnished for domestic space heating, now limited to 80% of last year's requirements, account for the 15,000,000-ton spread in requirements.

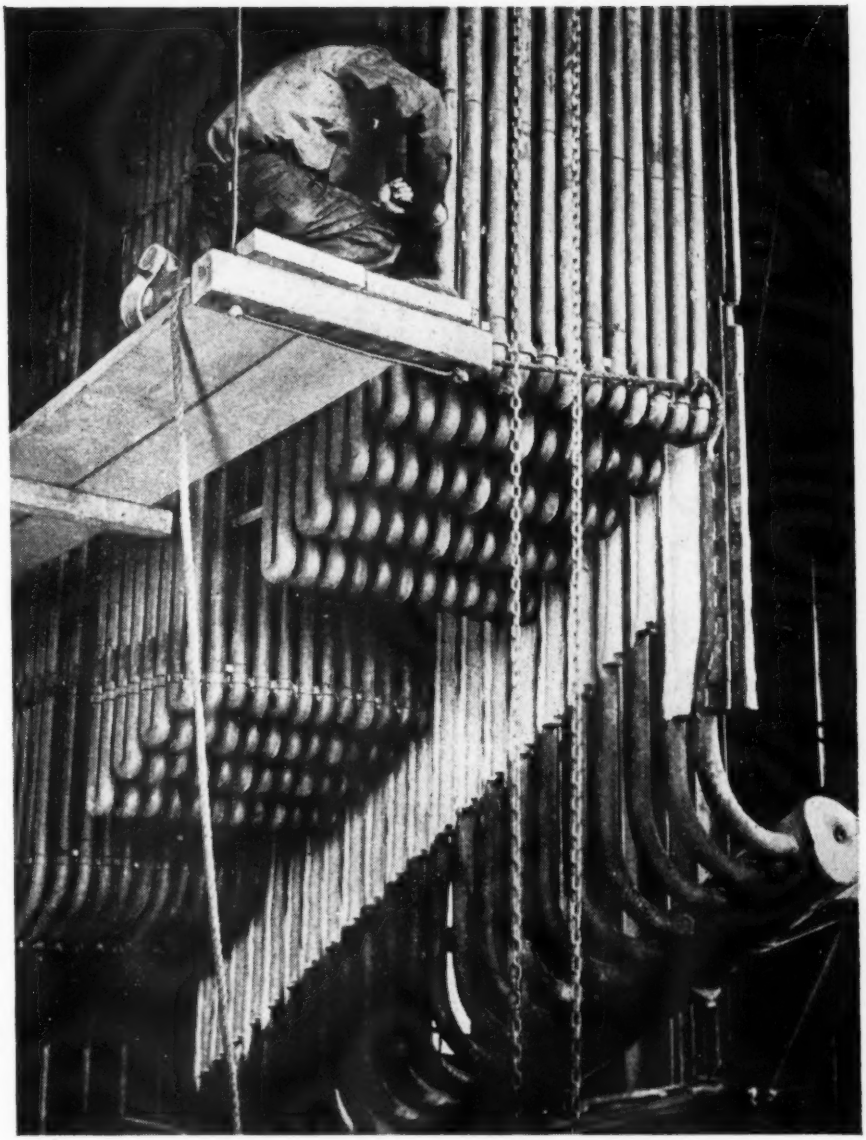
A coal shortage threatens in the East. The Midwestern coal situation is better and there is an adequate supply of Western coals. Western and Midwestern coals cannot be used in the coal-shortage area because of lack of transportation and unsuitability of much of the coal to the needs of the East.

Solid Fuels Administration for War estimates of coal requirements, by industries, based on post V-J Day conditions as compared to pre-V-J Day figures, show a decrease of 1,400,000 tons in electric power requirements, dropping to 76,500,000 tons.

OWU, Ickes said, anticipates no large decrease in coal requirements for power utilities. Civilian production has higher power requirements per man-hour than war industries. Unless unemployment rises to unexpected levels, coal needs will depend more on hydropower water conditions than on reconversion. Reductions in power

(*Continued on page* 204)

TUBES that are worth MILLIONS



t stake in every foot of B&W boiler tubing the 64-year reputation for dependable per-rmance earned by millions of dollars worth of &W industrial, central station and marine oilers.

o one could be more directly concerned with boiler's *performance* than the boiler *maker*—nd a boiler is no better than its tubes. No one, erefore, has a stronger incentive than B&W produce the best possible boiler tubes . . . be-use *no* other tube manufacturer is an integral part of an organization that also builds boilers. Every time you buy B&W tubes for *any* steam generating or heat transfer equipment, you get the same high quality, safety, dimensional accuracy and easy workability insisted upon in B&W tubes for all new B&W-built boilers. Besides, you get tubes matched to your specific service conditions without prejudice toward any type or materials because B&W makes BOTH SEAMLESS and WELDED TUBES—all to *one* high standard—for every power plant requirement.

B&W TUBES

SEAMLESS. Complete range of carbon alloys and stainless steels
Sizes: ½ in. to 8⅝ in. O.D.
ELECTRIC Resistance Welded Carbon grades
Sizes: 3/8 in. to 4 in. O.D.

THE BABCOCK & WILCOX TUBE COMPANY

Seamless Tube Division
BEAVER FALLS, PA.

Welded Tube Division
ALLIANCE, OHIO

B&W MAKES BOTH

TA1335

ARE THESE FELLOWS *Stealing Coal* FROM YOUR COAL PILE?

Clark Fluid Controls will stop them!

WATER AND AIR IN STEAM PIPES CAUSE EXCESSIVE USE OF COAL

When water condensate or air is permitted to remain in steam pipes, heat transfer is curtailed, pressure goes down and the consumption of fuel goes up. Furthermore, excessive condensate often causes "water hammer" which is dangerous to both piping and equipment. Do not permit these to happen this winter. Inspect your steam system and install Clark Traps where needed. Clark Traps save coal, increase steam efficiency and help protect steam systems and equipment.

CLARK TRAPS REMOVE CONDENSATE AND AIR WITHOUT STEAM LEAKAGE

While draining water and air from steam systems it is important that there be no leakage of steam. Coal is needed to produce steam—and coal will be precious this winter.

Steam leaks are costly—and sometimes create harmful back pressures in return lines. In vacuum systems, steam leakage tends to reduce or destroy the vacuum, overloading vacuum pumps, increasing operating costs and oftentimes slowing up and even stopping the return flow of condensate.

Clark Steam Traps operate without steam leakage. The effective valve mechanisms and "Clark-loy" precision lapped discs and seats prevent leaks.

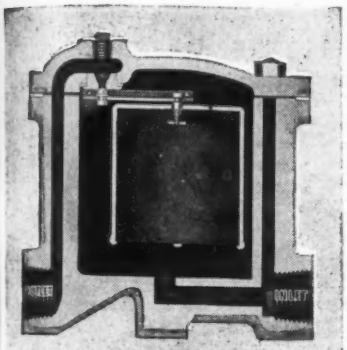
It will pay you to specify "Clark" when you need steam traps or other fluid controls.

Clark
FLUID CONTROLS

Clark
FLUID CONTROLS

SAVE COAL AND MONEY

Remove costly air and water condensate. Increase steam pressures. Accelerate plant production.



Clark Series "70" Steam Traps
Sizes ½", ¾" and 1". For Pressures to 200 P.S.I. Semi-steel Construction. "Clark-loy" Disc and Seat. Patented Bucket Vent. See Catalog T-1451.

CLARK OFFERS A FULL LINE OF FLUID CONTROLS FOR EVERY TYPE OF INDUSTRY

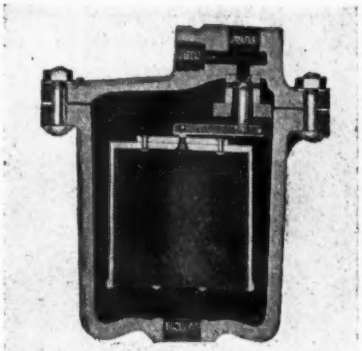
Although only four Clark products are pictured here, you'll find a complete line of Fluid Controls in the Clark Line—Steam and Fluid Traps, Inverted Bucket, Upright Bucket and Float Types, Vacuum and Lifting Traps, Pressure Regulators, Valves and Reducing Valves, Strainers and other fluid controls.

CLARK FLUID CONTROLS ARE DOUBLY TESTED

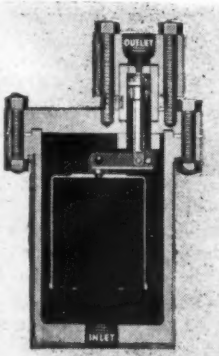
Every Clark Trap is subjected to a rigid hydrostatic test. Hot water at double operating pressure is used to detect casting flaws. To assure correct, dependable operation, all Clark Traps are next tested on special test equipment. Traps are discharged to atmosphere to permit close observation of both operation and rate of flow under varying test conditions.

AN OLD PRODUCT TAKES A NEW NAME

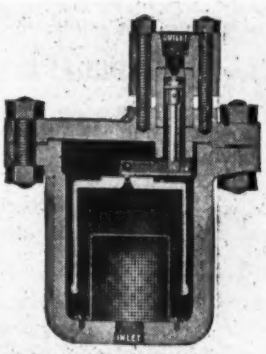
For almost four decades The Clark Manufacturing Company has manufactured a high quality line of fluid controls. Beginning July 1 of this year the complete line of steam specialties made by Clark assumed their own identity and are now offered to industry under the name "Clark Fluid Controls." Specify "Clark" and you get the finest in Steam Traps and Reducing Valves.



Clark Series "80" Steam Traps
Sizes ½" to 2½". For Pressures to 250 P.S.I. Semi-steel Construction. Dual Outlet. "Clark-loy" Disc and Seat. Patented Bucket Vent. See Catalog T-1451.



Clark Series "900" Steam Traps
Sizes ½" to 2". Fabricated Welded Steel for Pressures to 600 P.S.I. Externally Bolted-in. Heat-treated Alloy Ball Type Disc and Seat. See Catalog T-1451.



Clark Series "800" Steam Traps
Sizes ½" to 2". Forged Steel for Pressures to 1800 P.S.I. Built-in Strainer. External Discharge Valve. Patented Bucket Vent. See Catalog T-1451.

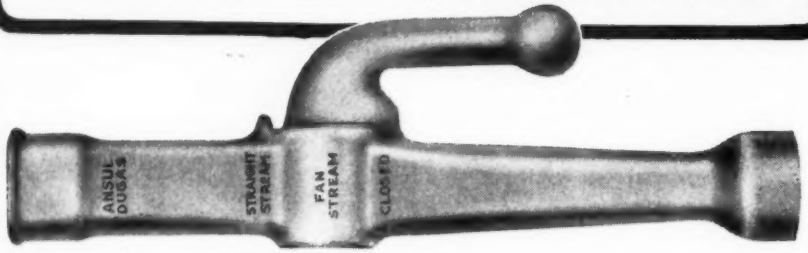
THE CLARK MANUFACTURING CO. · Cleveland 14, Ohio

WESTERN CANADIAN DIST.
MOORE DRY KILN COMPANY OF CANADA, LTD.
VANCOUVER, BRITISH COLUMBIA

★

EASTERN CANADIAN DIST.
LYTLE ENGINEERING SPECIALTIES, LTD.
360 NOTRE DAME ST. • MONTREAL 1, CANADA

NOW...NEW DUAL-STREAM NOZZLE
further steps up fire-killing punch of
DUGAS EXTINGUISHERS!



NEW DUAL-STREAM NOZZLE deals effectively with spill fires and fires difficult to reach because of height or obstructions. Designed for use with DUGAS wheeled extinguishers, the new Dual-Stream Nozzle greatly increases fire fighting range and effectiveness. A turn of the handle gives a *straight* stream with a range of 45 feet—or a *fan* stream with a range of 15 feet.

STRAIGHT STREAM of fire-killing DUGAS Dry Chemical permits a large fire to be knocked down from a safe distance before operator goes in to extinguish it.

FAN STREAM enables operator to concentrate heavy cloud of DUGAS Dry Chemical on fire and minimizes flash-backs.

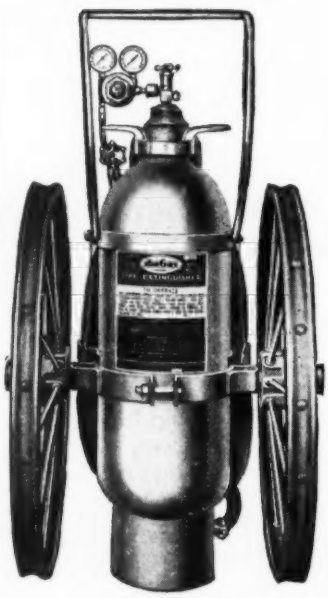
***Quick Facts about* DUGAS Dry Chemical**

- For extra-hazardous fires involving flammable gases, liquids, greases or electrical equipment.
- Not an electrical conductor.
- Non-toxic, non-corrosive, non-abrasive.
- Not affected by extreme cold or heat.

Write today for complete information regarding DUGAS Wheeled Extinguishers with the New Dual-Stream Nozzle . . . and DUGAS Hand Extinguishers.

AN ANSUL PRODUCT
duGas
THE MASTER OF FLAME

Approved by Underwriters' Laboratories, Factory Mutual Laboratories.



DUGAS 150-A WHEELED EXTINGUISHER

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

consumption because of the end of the war have affected hydropower more than energy derived from coal.

Earlier, Ickes had raised from 6,000,000 to 8,000,000 tons the amount of coal that he estimated could be sent to Europe, but added that none of the export coals would be useful for home heating. In addition, SFAW allowed the shipment of coal for commercial purposes to Sweden, Portugal, Switzerland, Denmark and North Africa, but warned that commercial shipments to these countries would be charged against the 8,000,000-ton quota. SFAW must approve coal sources for such shipments before contracts can be made.

One government official predicted that as much as possible of the export coal would be in "fines" and other hard-to-dispose-of sizes as moving these sizes promptly would keep mine storage grounds free and permit the continuation of full production.

TAB Makes Plans For Experimental Work

Technical Advisory Board of Bituminous Coal Research met at Battelle Memorial Institute in Columbus, Ohio, recently to hear progress reports and to make plans for continuing experimental work and studies.

An encouraging report was made by John I Yellott, director of research for Locomotive Development Committee of BCR, who outlined the experimental work now getting under way to develop a coal-burning gas turbine. After visits with gas-turbine manufacturers, who offered their cooperation and discussed the problem of adapting coal to their machines, plans were made for research at several laboratories on various phases of the combustion of pulverized coal under pressure. The Johns Hopkins University is the first to receive a definite assignment on combustion chambers.

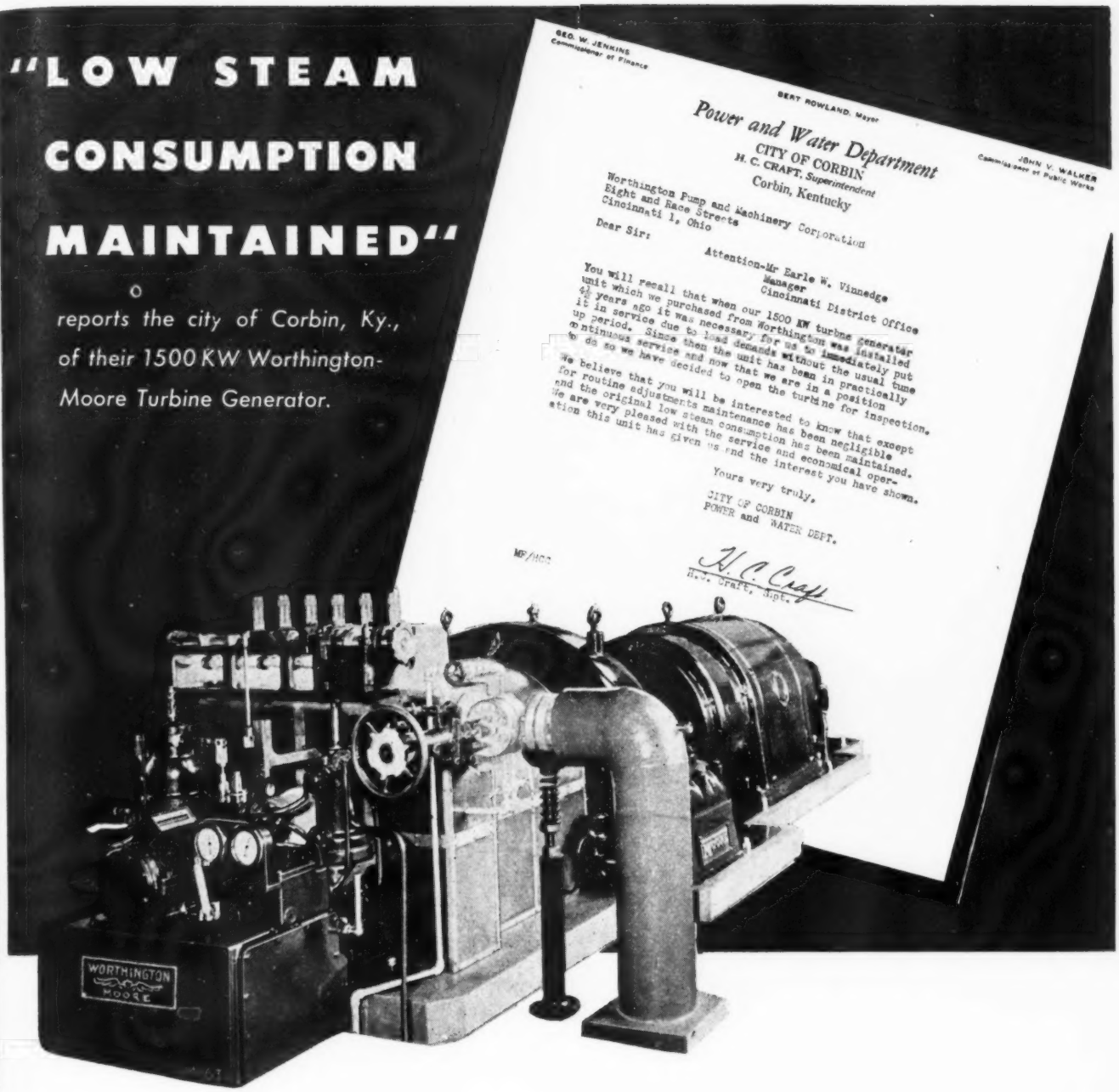
For the benefit of the gas industry, tests at 1850 and 2100 F were conducted to gasify pulverized lignite and outcrop bituminous coal with steam. Based on rates of gasification found by test, a cooperating manufacturer is making estimates to determine cost of a full-scale plant.

Plans are going ahead for a patent application on the recently developed meter for measuring the flow of pulverized coal and air mixtures. Industrial installations of the meter will be made to determine effect of various sizes of pipes. The meter will be particularly useful in controlling flow of pulverized coal in branch lines supplied from a single pulverizer.

ANNUAL MEETING of American Welding Society, usually held during Oct, will not be held this year because of travel restrictions and hotel housing conditions. A meeting of the national officers, board of directors and committee chairman will be held in New York at the Hotel Pennsylvania on Oct 18 to deal with mattters which require official action that cannot be delayed. The Program Committee of the society has arranged for presentation of the papers prepared for it in the *Welding Journal*, the society's monthly magazine.

"LOW STEAM CONSUMPTION MAINTAINED"

reports the city of Corbin, Ky., of their 1500 KW Worthington-Moore Turbine Generator.

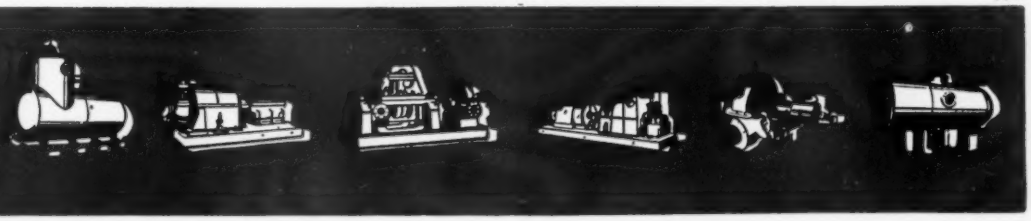

GEO. W. JENKINS
Commissioner of Finance
BERT ROWLAND, Mayor
Power and Water Department
CITY OF CORBIN
H. C. CRAFT, Superintendent
Corbin, Kentucky
JOHN V. WALKER
Commissioner of Public Works
Worthington Pump and Machinery Corporation
Eight and Race Streets
Cincinnati 1, Ohio
Dear Sir:
Attention-Mr Earle W. Vinnedge
Manager
Cincinnati District Office
You will recall that when our 1500 KW turbine generator unit which we purchased from Worthington was installed 6½ years ago it was necessary for us to immediately put it in service due to load demands without the usual tune up period. Since then the unit has been in practically continuous service and now that we are in a position to do so we have decided to open the turbine for inspection.
We believe that you will be interested to know that except for routine adjustments maintenance has been negligible and the original low steam consumption has been maintained. We are very pleased with the service and economical operation this unit has given us and the interest you have shown.
Yours very truly,
CITY OF CORBIN
POWER and WATER DEPT.
H. C. Craft, Supt.
WORTHINGTON
MOORE

Low maintained steam consumption, freedom from operating troubles and the ability to be placed in continuous service immediately after erection without a "tune-up" period are typical characteristics of all Worthington Turbine Generator units. This is made possible by our practice of testing the complete unit under operating steam conditions and load at our works before shipment . . . Write today for Bulletin 1960 . . . further proof that *there's more worth in Worthington*. *Worthington Pump and Machinery Corporation*, Moore Steam Turbine Division, Wellsville, N. Y.

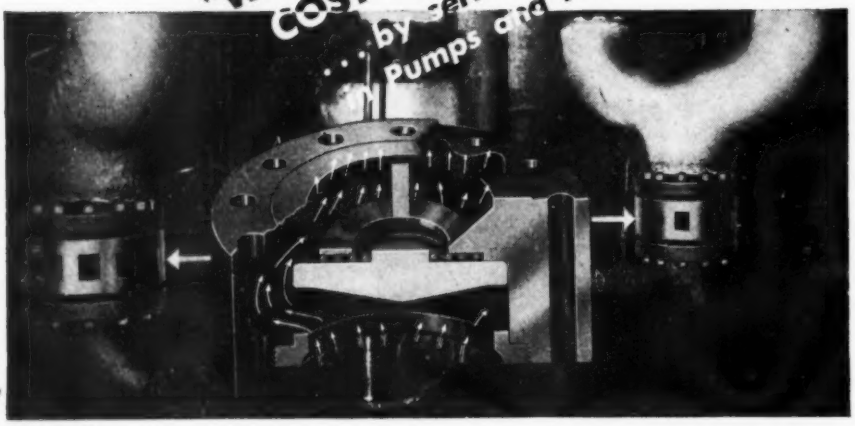
WORTHINGTON

A GREAT TEAM IN STEAM

T5-2



"WATER HAMMER" COSTS YOU MONEY!
. . . by serious breakdowns
Pumps and Piping Systems



WILLIAMS-HAGER FLANGED Silent CHECK VALVES

Precision Engineered to Eliminate "HAMMER and BANG" in ANY system with Operating Pressures up to 6,000 lbs.

specified by Leading Industries for such exacting uses as:

Public Utilities · Water Works · Industrials · Oil Refineries · Paper Mills · Hotels · Hospitals · Chemical Works · Office Buildings · Public Buildings · Breweries · Steamship Lines, etc.

Heavy duty service records upwards of 17 years without removal from lines . . . Williams-Hager Flanged Silent Check Valves are built to meet the exacting requirements of any end use. No webs to restrict or hamper the flow of liquids . . . the free-floating valve will operate normally and efficiently in *any* position.

Dependably constructed in sizes from 1" to 20" inclusive, from iron, semi-steel, bronze, cast steel, stainless steel or monel . . . pressure resistant to 6,000 pounds.

Do you have the new Williams Catalog for Power Plant Equipment?

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

2055 Pennsylvania Ave. Pittsburgh, 12, Pa.

APPOINTMENTS

General Electric Co has appointed Harry A Winne as vice-president in charge of engrg policy for entire company. Ernest E Johnson has been named to succeed Mr Winne as apparatus dept's engrg manager. G L Crow has been made manager of marine section of Pacific district industrial div. His office will be at San Francisco.

Henry I Guy, asst manager of transportation divisions at **General Electric's** Erie Works, retired after more than 40 yr of service with the company. F H Craton will assume his responsibilities as asst manager. Edith Clarke, an expert on electric power systems, retired after 26 yr of employment with GE.

Fairbanks, Morse & Co appoints Lewis A Harlow advertising manager. He was formerly asst advertising manager.

C D Carter has been promoted to manager of the central div of **Iron Fireman Mfg Co,** with headquarters in Cleveland, Ohio. S W Alford succeeds Mr Carter as sales manager of southern div in Atlanta, Ga.

Iron Fireman Mfg Co has taken over the plant and business of L R Teeple Co. The plant will now be known as the heating control div of Iron Fireman Mfg Co.

Diesel Marine & Equipment Corp has been named marine sales and service distributor for the metropolitan New York area, western Conn. and northern N. J. by the Detroit diesel engine div of **General Motors Corp.**

Rogers Diesel & Aircraft Corp announces appointment of Walter Parrish as chief engineer. Mr Parrish takes charge of engrg, research and development facilities of parent company, as well as aiding in formulation of engrg plans for entire organization, which includes Edwards Co, Hill Diesel Engine Co and Ideal Power Lawn Mower Co.

Homer F McDonald was appointed president of **Bell & Zoller Coal Co,** succeeding David H McMaster, who resigned. Edward L Carr fills position of vice-president vacated by Mr McDonald.

A O Smith Co announces that Wilbert M Beck and Rush H Hobbs have joined its stoker div as district representatives. Both will work under direction of R H Stuff, stoker div sales manager in Chicago office. Mr Beck will cover Wis., Minn. and upper peninsula of Mich. Mr Hobbs will cover Iowa and Ill.

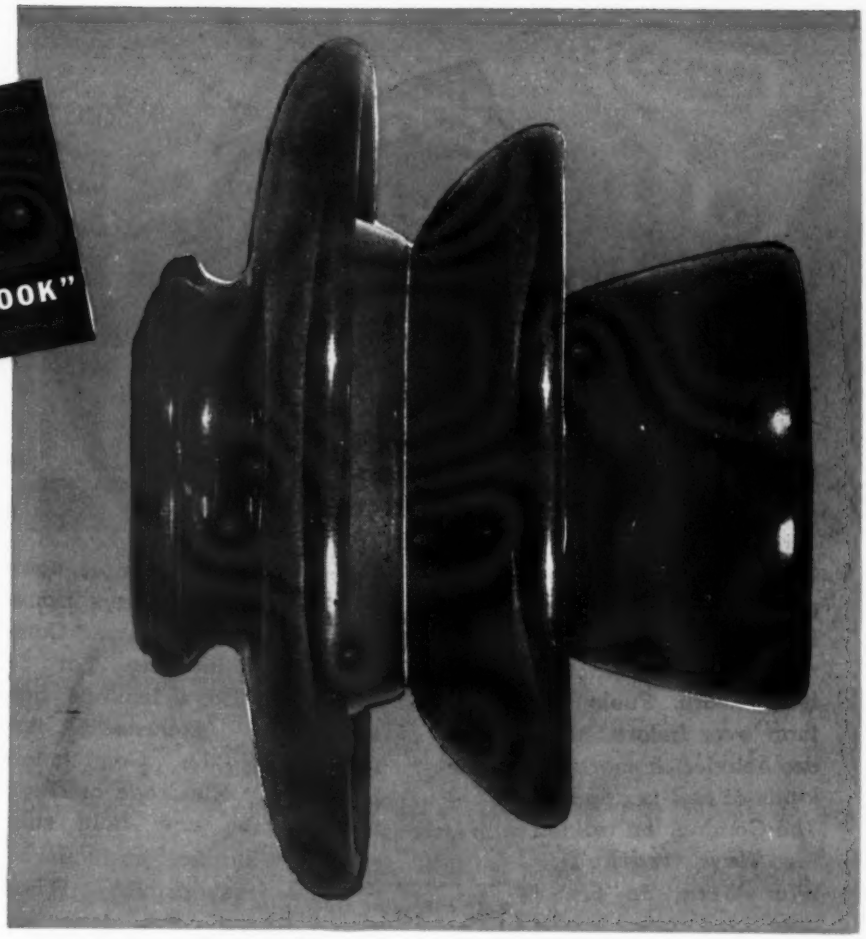
Westinghouse Electric Supply Co names W E Knapp, Jr, branch manager of company's Fort Worth house, succeeding E C Cummins, who resigned.

Hobart C Ramsey, executive vice-president of Worthington Pump & Machinery Corp has also been named president of **Ransome Machinery Co,** subsidiary of Worthington, in Dunellen, N. J. J G Ten Eyck has been named vice-president and general

PAGE 4

OAKITE

"PRESCRIPTION NOTE BOOK"



ONE OF A SERIES of data sheets for power plant engineers outlining various Oakite maintenance and equipment cleaning tasks. Each sheet may be filed for reference to serve as a reminder for obtaining more specific information.

Cleaning Porcelain INSULATORS Used on High Voltage Lines

Other Power Plant Cleaning Jobs for OAKITE

Automatic Filters . . . Electrical Precipitators . . . Controlling Slime and Scale Formation in Air Wash Air Conditioning Units . . . Cleaning Evaporative Condenser Coils . . . Controlling Slime and Mold in Humidifying Systems . . . Cleaning and Descaling Diesel or Gasoline Engines . . . Cleaning and Descaling Jacket Water Coolers and Lube Oil Coolers . . . Cleaning Surface Condensers . . . Cleaning Water and Steam Condensate Meters . . . Descaling Water Cooled Compressors . . . Cleaning Unit Heaters . . . Descaling Ammonia Condensers . . . Cleaning Transformers . . . Cleaning Painted Surfaces of Equipment . . . Stripping Paint . . . Cleaning Floors.

As a result of long exposure to the elements, porcelain and similar type insulators on power transmission lines acquire deposits such as soot, iron, and coal dust, chemicals, dirt and various other films. Under certain conditions these built-up films are potential sources of flash-overs and short circuits.

Eventually insulators have to be removed and replaced. Practice of many utility companies is to clean and recondition them by various methods. Depending on nature of deposits on surfaces, a one-step or two-step Oakite method will effectively remove them in most cases. Either manual or tank procedures may be employed. Oakite Technical Service Representatives will gladly share their experience with you so as to help you handle this work on a satisfactory, low-cost basis. Inquiries invited and promptly answered.

OAKITE PRODUCTS, INC., 23 Thames St., NEW YORK 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized cleaning*

MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Combustion efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man — can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

Just a Few of Our Hundreds of Friends

International Harvester Co. 35
Armour and Co.....75
Combustion Engineering Company 45
Riley Stoker Corp....75
Iron Fireman Mfg. Co. 35
Commonwealth Edison Company..145
State of Illinois.....85
Cities Service (Oil & Power) 70
and many others.

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The coupon below will bring you, without expense, full particulars regarding the Hays short, practical, easy reading, home study Course in Combustion. Do your part by starting now to train yourself in the uncrowded wide open field of Fuel and Combustion Engineering. Hays trained men are in demand, today more than ever. Send the coupon Now. No obligation of course.

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Company Name .....

manager of the Dunellen plant. Kenneth W Horsman has been transferred to Ransome as works manager. Newly elected directors of Ransome are Ten Eyck and Carl F Oechsle.

Plans are now complete to run a large part of heavy ordnance mfg facilities of **Worthington Pump & Machinery Corp's** plant in Holyoke, Mass., into production of air-conditioning and refrigeration equipment. Facilities for the operation have been moved there from Harrison.

Peerless pump div of **Food Machinery Corp** has rearranged territorial distribution by establishment of five sales districts: Warner G Vaughan has been appointed Atlantic district sales manager, with offices in Ardmore, Pa. Southeastern territory has been placed under management of Charles E Tierney, with offices in Decatur, Ga. Edward W Pierce will continue in charge of Central territory and as district sales manager is making his headquarters at Peerless Canton, Ohio, works. Southwestern territory has for its district sales manager William E Griffin, whose headquarters are in Plainview, Tex. B A Tucker is Pacific district sales manager with headquarters in Los Angeles, Calif.

Baldwin Locomotive Works appoints Adolph G Hochbaum managing director for exports to USSR and general sales representative for central and eastern European countries.

Cornell & Underhill, Inc, announces appointment of F Carroll Stille as sales mgr.

Certified Alloy Valve Co has been formed as a new div of Cooper Alloy Foundry Co. P C Shaffer is chief engr. Products will be sold through Cooper.

Gunnar Sinding-Larsen becomes vice-president and D M Weir Jr general manager of sales of **Pittsburgh Piping & Equipment Co.**

Parker Appliance Co elects S B Taylor president. Mr Taylor succeeds H I Markham, who, until his recent elevation to chairman of board, has served as president, following death of Arthur L Parker. Mr Taylor was also elected a director.

Sigfried A Olson Jr has been named industrial mgr at Stockholm, Sweden, for **Brown Instrument Co,** Philadelphia div of Minneapolis-Honeywell Regulator Co.

Portable Products Corp appoints E D Wacker general manager of its C J Tagliabue div, located in Brooklyn, N. Y.

Foxboro Co announces that Clarence L Williams has joined its staff of sales engineers, whose headquarters are at 420 Lexington Ave, New York City. He has been assigned to northern New Jersey territory.

A C Monteith has been appointed assistant manager of headquarters engrg of **Westinghouse Electric Corp.** Mr Monteith will direct headquarters engrg activities

(*Continued on page* 212)

DEPENDABLE DELIVERY

THE Shaw Production Department, immediately contracts are received, schedules material supply and shop facilities accurately—to meet delivery requirements consistent with the customer's needs. Because time schedules are considered so vitally important, our organization is prepared to meet your delivery requirement on Pre-Fabrication and Installation — regardless of the size of the contract.

Manager of Production Department

Known since 1893 for Dependable Delivery and Quality Prefabrication and Piping Installations

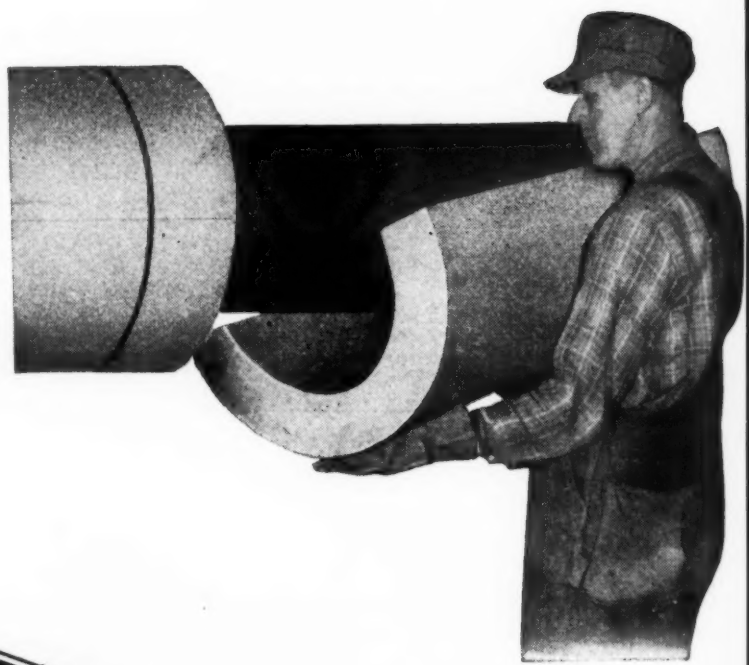
BENJAMIN SHAW, INC.

Second & Lombard Streets • Wilmington 99, Del.

Piping Distributors Contractors Fabricators

Unibestos, the sectional insulation, will not dent, shatter, sag or gap as the result of vibration, exposure to moisture or hard knocks. This greater structural strength is a result of Unibestos' resilient, tough fibrous construction.

Unibestos is available in half-section form up to 30" pipe diameter and in quarter sections from 32" to 60", in thicknesses from ¾" to 5". Single layer construction is available for service up to 1200°.



UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

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PLANTS: 1821 S. 54th Ave., CICERO, ILL. • PATERSON, N. J. • BLUE ISLAND, ILL.
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UNION ASBESTOS AND RUBBER CO.

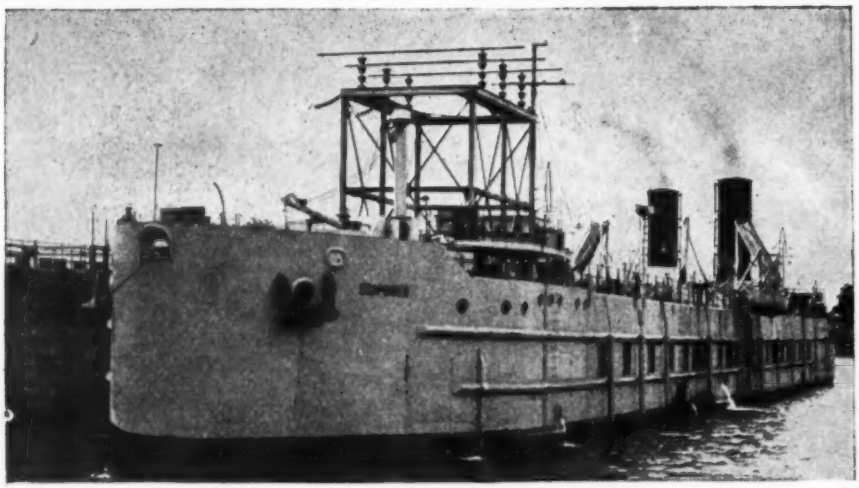
MEANS PROGRESS IN INSULATION AND PACKING

UNIBESTOS INSULATION

Unibestos insulation in sectional block and sheet form is a molded asbestos material made from resilient Amosite asbestos fibres and a binder that will not boil out in water. Its main characteristics are a very high thermal efficiency combined with unusual mechanical strength before and after exposure to high temperatures; and a capability of being molded and formed into large semi-sections up to 30" in diameter and up to 5' in diameter in quadrants. In sheet form it is available in sizes up to 36" x 36", in thicknesses up to 5". This, plus its quality of exceptionally light weight, makes it a most effective material for simple fast application. It gives off no dust during application, therefore the usual cleaning expense encountered when powdery molded insulations are used is eliminated.

Available in single layer construction in thicknesses up to 5". There is no shrinkage up to 750° and infinitesimal shrinkage after that. It is ideal for underground or outdoor work because it stands submersion in water—will not "pulp" or wash off—is as good as new when dry again.

"WATER, WATER EVERYWHERE"



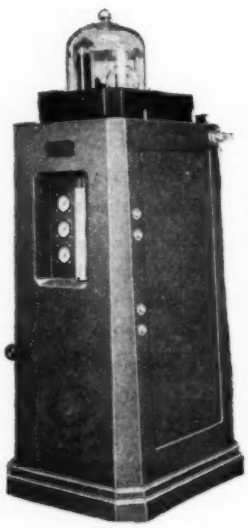
. . . BUT NOT A DROP FOR *Cooling*

BECAUSE OF MICROBIOLOGICAL CONTAMINATION

That was the problem faced by United Engineers and Constructors — a problem solved by CHLORINATION — in their part of building four 30,000 KW Floating Power Plants* for Defense Plant Corporation. It was the same problem that every power plant — afloat or ashore — must solve to enjoy economical and effective condenser operation.

All cooling water is polluted to some degree by microbiological organisms which form insulating deposits on condenser water side surfaces. These deposits cause loss of heat transfer and result in excessive time out for cleaning. Chlorination destroys the organisms quickly without affecting tube life, and by *preventing* slime deposits regardless of the bacterial quality of the cooling water, saves labor, time and money.

In the case of these Floating Power Plants — intended for emergency use — the elimination of "time out" for cleaning was the prime consideration, but that is only one of the many savings which chlorination can give — one of the many benefits which W&T Engineers will be glad to show you following a survey of your particular problems. Why not call on them today?



**Designed, in collaboration with the U. S. Army Engineers, by Gielow Inc., and hulls built by Bethlehem Steel Co.*

WALLACE & TIERNAN PRODUCTS, INC.

Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey • Represented in Principal Cities

CD-195

in absence of C A Powel, assigned to military government of Germany with responsibility for establishing control of electrical and radio mfg in that country. Mr Monteith has also been made director of education. Charles W MacLean becomes manager of educational dept. Lloyd A Russ has been made manager of agency and specialties dept. Mr Russ succeeds W D Turnbull, who resigned.

Appointment of F E Williams as general sales manager and C E Sexauer as service manager of Zenith carburetor div of **Bendix Aviation Corp** was announced.

H M Nazor has taken over management of **Graybar Electric Co's** Akron, Ohio branch. K B Mayer has been transferred to Chicago where he will supervise rural lines dept activities.

R G LeTourneau, Inc, announces addition of Robert F Nelson to its staff as vice-president and asst to president.

Hewitt Rubber Corp has acquired a controlling interest in Robins Conveyors Inc. To render better service in W. Va. territory, Robins Conveyors and Hewitt Rubber have opened a new office in Charleston, W. Va. R U Jackson will be in charge of this office and will be assisted by H N Kepler. Nelson J Reinhold will handle Hewitt sales.

Electric Machinery Mfg Co announces appointment of James De Kiep as chief engineer in charge of electrical and mechanical design and development.

Lee H Hill, vice-president in charge of industrial relations at **Allis-Chalmers Mfg Co,** has resigned. Mr Hill has accepted a position with McGraw-Hill Publishing Co. J Warren Roberts has been appointed branch manager of Allis-Chalmers office in Chattanooga.

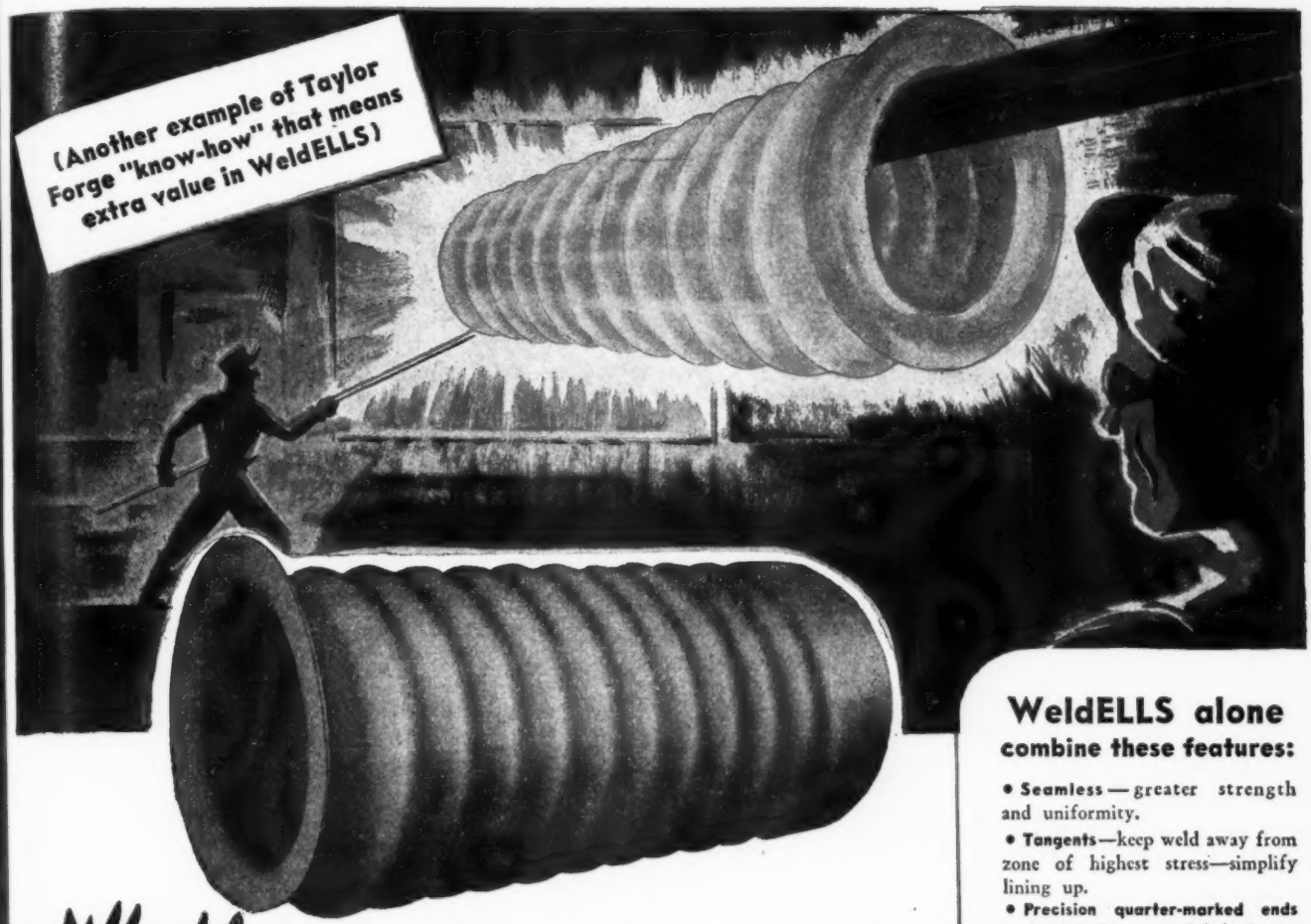
E G Cross has been appointed supervisor of production planning and control dept of **Crocker-Wheeler div,** Joshua Hendy Iron Works, at Ampere, N. J.

Dampney Co of America names John W Laverack president. He succeeds Clarence J Hunter who becomes chairman of board and technical director.

Monsanto Chemical Co appoints H J Heffernan asst general manager of sales of its Merrimac div. J J McCarthy has been promoted to div sales dept as manager of textile sales development. Three asst sales managers were advanced to sales managers of their respective departments: W R Minchin becomes sales manager of heavy chemicals dept of div, T C Jesdale sales manager for organic and phosphate div products at Merrimac div and P O Huntington sales mgr of Merrimac alcohol dept.

Arnold H Smith has been appointed director of foreign dept of **Monsanto Chemical Co,** succeeding Herbert M Hodges who is retiring. However, Mr Hodges will remain with the company, with title of over-

(*Continued on page* 216)



What! Horse Collars Aboard Ships?

★ *To the ordinary landlubber this is only a queer looking piece of pipe; but to the marine engineer it is a Morison Type Corrugated Furnace, one end horse collar, other end plain. Such furnaces are a vital part of the compact, sturdy and efficient Scotch Marine Boilers that power so many small cargo vessels.*

For more than 30 years Taylor Forge has been the leading American maker of these fireboxes. Experience thus gained has added its share to our knowledge of how hot metal behaves —how to make it go where you want it to go.

YES, if you know how to make forging-temperature metal go where you want it to go, and in the right amounts, there are a lot of things you can do—and do *better.* Take Welding Fittings, for example, specifically welding elbows. You can have:

- Full pipe wall thickness at all points *plus* the right amount of reinforcement to provide full, uniform strength . . . as WeldELLS have.
- Tangents that help in lining up and keep the welds away from the zone of highest stress . . . as WeldELLS have.
- Perfect circle cross section for best flow conditions . . . as WeldELLS have.
- Finest metallurgical structure for greater strength . . . as WeldELLS have.

If you add such features as quarter-marked ends, permanent and complete identification marking, machine tool beveled ends, extreme dimensional accuracy, then you have fittings like WeldELLS: for indeed—

WeldELLS have everything

WeldELLS alone combine these features:

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

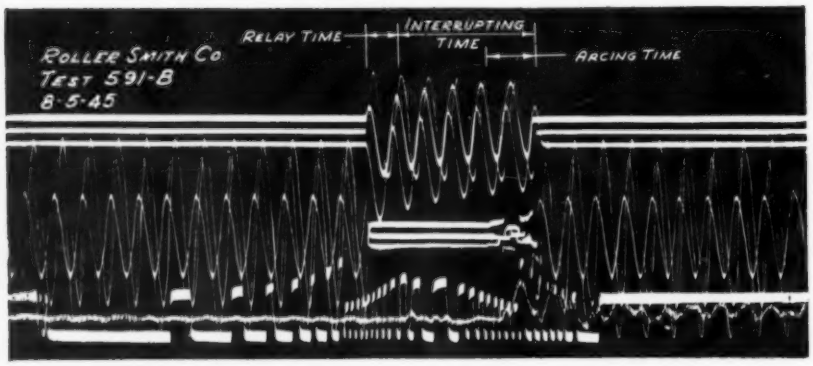
TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

ROLLER SMITH

"ON THE LINE" TEST STATION PROVIDES KEY TO SECRETS OF ARC EXTINCTION

THE new Exotherm principle of arc extinction discovered by Roller-Smith engineers puts arcs out faster because it harnesses the properties and energy of the gases produced when the arc is struck.

The discovery of the Exotherm principle grew out of the efforts of Roller-Smith engineers to reconcile conventional laboratory tests of breakers with performance "On the Line." The only answer seemed to be "On the Line Testing" of breakers. Through cooperation of the utility industry the first "On the Line" test station of its kind was established by Roller-Smith to seek out the real facts about oil circuit breaker performance. Because the tests were conducted under actual operating conditions, the full value of recovery voltage, both normal and transient, came into play. For the first time conflicting theories and claims about arc extinction could be tested under actual service conditions. After hundreds of tests "On the Line," provided information never before available, the Exotherm principle of arc extinction was discovered. A chamber in which the arcing takes place confines the gas, compresses it, and correlates the thermal and pressure characteristics to obtain rapid arc extinction.



Typical test oscillogram of Roller-Smith oil circuit breaker employing Exotherm principle. Note 5 cycle interrupting time.

Roller-Smith oil circuit breakers with the Exotherm principle give consistent 5 cycle operation; little or no burning of contacts and low pressures inside the tank. 5 cycle operation means better protection to equipment with resulting savings. Making use of the arc energy results in less contact burning and less oil sludging, saves inspection and maintenance. Low tank pressure results from the Exotherm principle because the gas is cooled and contracted before it gets into the tank. The result —far greater safety for indoor operation than ever before.

For full information on the Exotherm principle applied to Roller-Smith oil circuit breakers, write to dept. **P.**

ROLLER SMITH

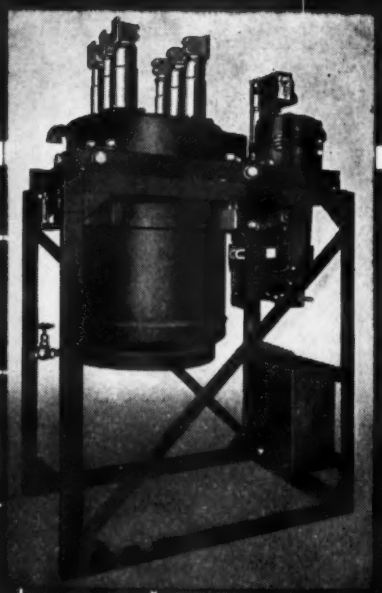
Oil Circuit Breakers

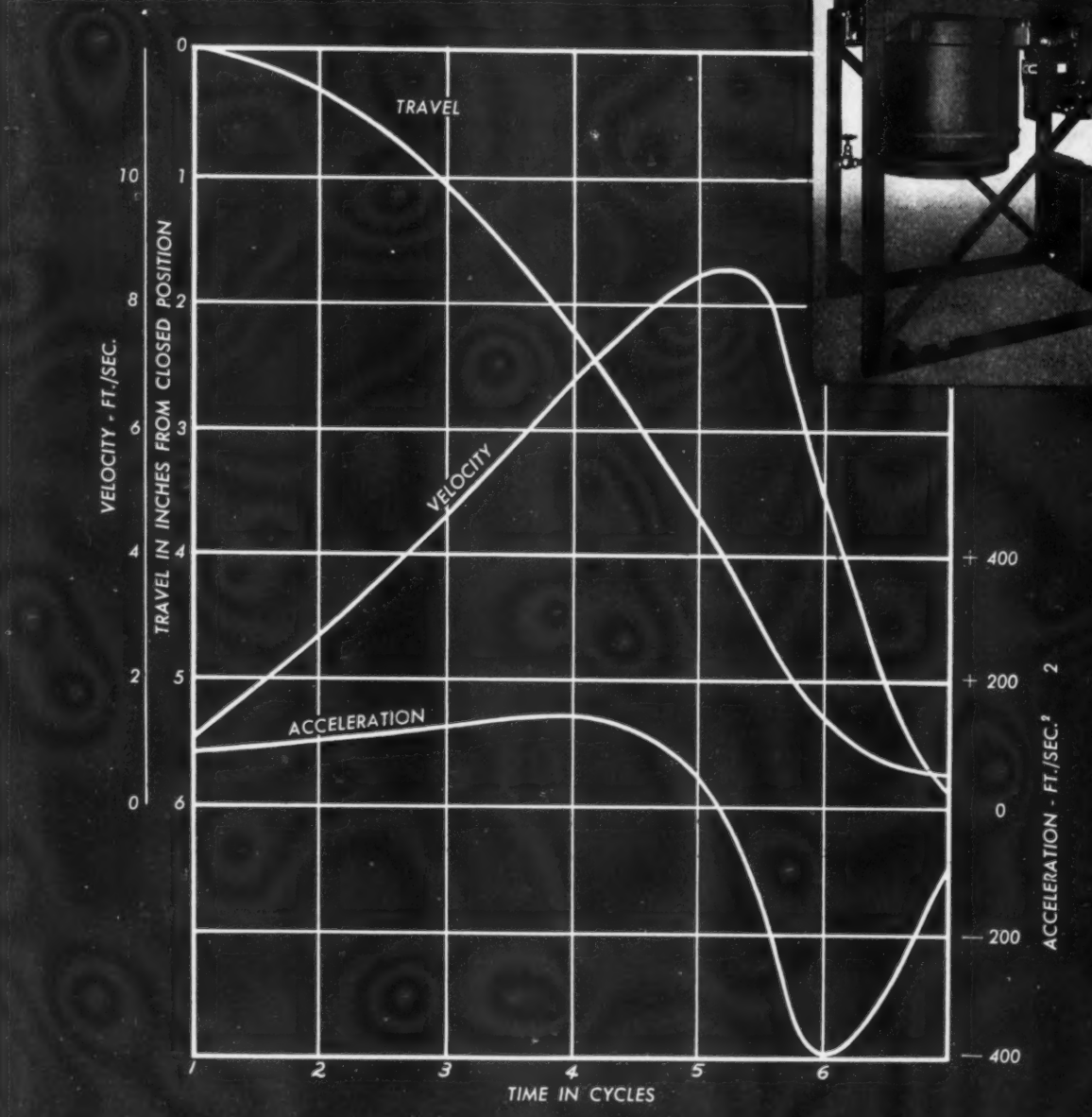
BETHLEHEM • PENNSYLVANIA

In Canada: Roller-Smith Marsland, Ltd., Kitchener, Ontario

STANDARD AND PRECISION ELECTRICAL INSTRUMENTS • AIRCRAFT INSTRUMENTS • SWITCHGEAR
AIR AND OIL CIRCUIT BREAKERS • ROTARY SWITCHES • RELAYS • PRECISION BALANCES

Announces




TRAVEL
VELOCITY
ACCELERATION
VELOCITY - FT./SEC.
TRAVEL IN INCHES FROM CLOSED POSITION
ACCELERATION - FT./SEC.²
TIME IN CYCLES
0
1
2
3
4
5
6
10
8
6
4
2
0
+ 400
+ 200
0
— 200
— 400

Accurate Regulation

STICKLE VALVES

Dependable Operation

● The functional standards for Stickle Valves are established by the requirements of industries in which steam pressures must be automatically controlled within exceptionally close variations. Consequently Stickle Valves possess the ultimate in sensitivity, accuracy and dependability. Long experience in building to such standards plus the fact that final assemblies are made to meet specific operating conditions and tested for tightness at pressures and temperatures specified for use, result in better equipment and superior performance.

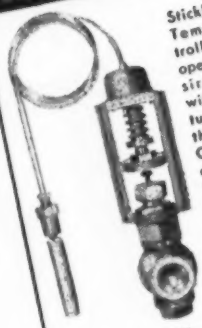
Available in two series—Double-seated, Semi-balanced, (Series 200—see Bulletin No. 235) and Single-seated, balanced, (Series 400—see Bulletin No. 435) construction—in types and sizes to meet the requirements of industrial applications for the regulation of water, air, and steam.

Spring Loaded, Diaphragm Operated and Lever Weight Loaded, Diaphragm Operated Balanced Valves—Stickle 400 Series. Also made in Lever type.

Lever Type Semi-Balanced Valve—Stickle Series 200. Also made in Weight Loaded, Diaphragm Operated and Pilot Operated Types. In same series: Float Valves and Back Pressure Relief Valves.

Spring Balanced Reducing Valve for standard service on water, steam and air.

Temperature Control Valves



Stickle Series 500 Temperature Controllers can be set to operate at any desired temperature within the temperature range for which they are constructed. Controllers consist of a Stickle Special Single-seated, Balanced Valve opened and closed, automatically, by an all-metal seamless bellows, which is operated by power generated by sensitive thermostatic bulb. Settings for increasing or decreasing temperature easily made with adjusting nut. Valve sizes: ½", ¾", and 1".

ASK FOR BULLETIN No. 501

OTHER STICKLE EQUIPMENT

Stickle Open Float Steam Traps
Four series designs to meet specific operating conditions. Specify use in requesting bulletin.

Stickle Differential Drainage and Boiler Return System
A closed pumping system for increasing boiler capacity and reducing fuel cost. Bulletin No. 250.

Stickle Open Coil Feed Water Heaters and Purifiers
Heat more water in less space. Trouble free. Deaerating and non-deaerating types. Ask for Bulletin No. 117.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

seas director, until completion of a special mission to China, India and S Africa. Mr Smith will be succeeded as asst director of foreign dept by Marshall E Young. Mr Young will accompany Mr Hodges on his mission to open agencies and appoint representatives in countries visited.

Monsanto Chemical Co announces retirement of Gaston F DuBois, vice-president and member of executive committee. He will continue as a director and will also serve as a consultant to company.

John E Gurvin has been appointed vice-president of **Merritt Engrg & Sales Co.** The Merritt Co is a Monsanto subsidiary.

Appointment of C L Owens as general sales manager of **Philip Carey Mfg Co** has been announced recently.

A P Green Fire Brick Co has moved its advertising and public relations dept from its general offices and plant at Mexico, Mo., to St. Louis, with offices in the Railway Exchange Bldg. All advertising is now being handled from that office.

Effective Jan 1, 1946, Addison Vars Co will direct the advertising account of **Carborundum Co.** In heading up contact for the agency, K S Duffes will be in direct charge of space buying.

William E Zipp has been appointed vice-president in charge of sales for mfg div of **Ceco Steel Products Corp.** He will have headquarters in div's plant in Cicero, Ill.

Republic Steel Corp elects N J Clarke senior vice-president and J M Schlendorf vice-president in charge of sales.

Robert Hetherington & Son announces opening of a West Coast office at 5607 W Adams Blvd, Los Angeles, Calif. Sales on the West Coast will be under C E Fisher. Hetherington engrg on the West Coast will be under direction of L E Massie, operating from same office.

K M Irwin was appointed manager of engrg dept of **Philadelphia Electric Co** and subsidiary companies.

National Electric Products Corp appoints Walter J Barnes Southern district sales manager. He will make his headquarters in Atlanta, Ga.

Bowser, Inc, acquired another wholly owned subsidiary in furthering its postwar expansion program with the purchase of Peterborough Lock Mfg Co, Ltd, Canada.

Diesel Equipment Co, 308 S 2nd St, Memphis, Tenn., has been appointed distributor for **Briggs Clarifier Co.** Territory assigned includes western Tennessee and northeastern Arkansas and portions of southeastern Missouri, southern Illinois, southern Indiana and southern Kentucky.

Kellogg Switchboard & Supply Co announces that Roy Augustine, of Kellogg switchboard engrg div, has been assigned to European occupation zone for attach-

What makes your town tick?

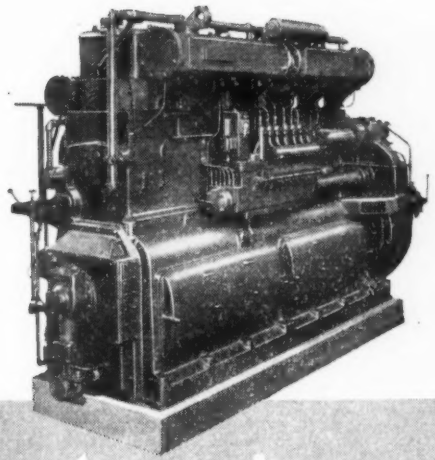
The answer, of course, is *power.*

Factories, offices and homes, today, are geared to dependence upon power. Power always available—instant and adequate.

That is the big advantage of ALCO diesel engines over many other types of prime movers. Their power is always available, always ready.

Other ALCO advantages are high capacity per unit of space—and weight. ALCO engineers pioneered lighter-weight, more compact, higher-speed diesel engines—proved that less weight and bulk could be combined successfully with higher engine power and greater durability.

More than a million and a half horsepower of ALCO diesel engines are in central stations, ships, oil-well drill-rigs, pumping stations, stores, hospitals, dredges, tugs, ferries, mines, mills and many other applications requiring dependable, economical power.



American Locomotive

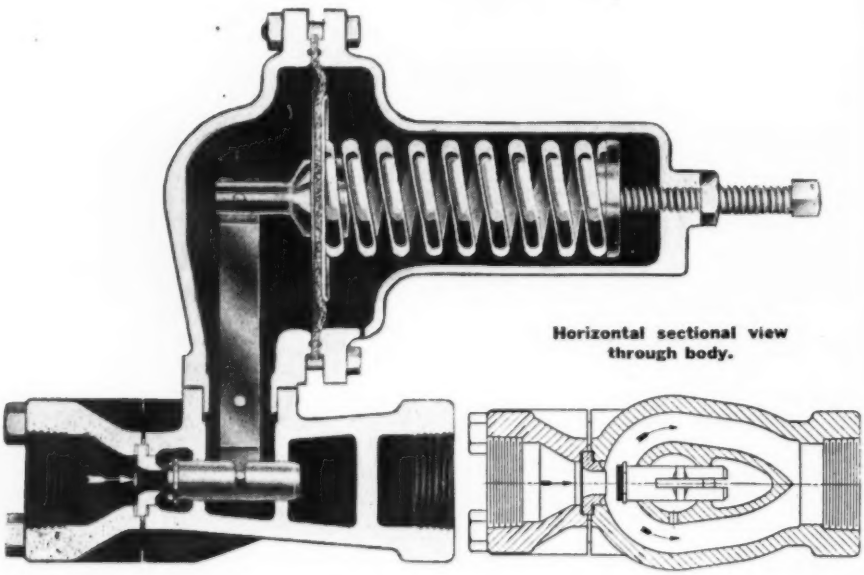
ALCO DIESEL ENGINES
For Universal Application

30 Church Street, New York 8, N. Y.

FISHER "BIG JOE"

FOR AIR PRESSURE REDUCTION THROUGHOUT THE POWER PLANT

Easy to Install . . . Simple to Adjust . . . Requires Only Limited Installation Space Extra Large Capacity . . . Accurate and Dependable . . . Rugged Construction . . . Trouble Free Long Life . . .



Horizontal sectional view through body.

FEATURES AND SPECIFICATIONS:

1. Exclusive design provides unusually large capacity.
2. Maintains reduced pressure setting within very close limits.
3. Extremely compact (15 to 16" overall length, maximum height 10½") — easy to install — controlled pressure setting easily changed.
4. Can be installed in any desired position.
5. Two diaphragm assemblies for reduced pressure ranges of 5 to 30 PSI and 27 to 150 PSI — interchangeable on both body sizes.
6. Body and spring housing heavy high-tensile iron — inlet adaptor malleable iron for pressures up to 1000 PSI — orifice brass or stainless steel.
7. Pipe sizes 1" and 2" — various orifice sizes as required.

Write today for Bulletin 43F.

FISHER GOVERNOR COMPANY
440 Fisher Bldg. • MARSHALLTOWN, IOWA

ment with a military mission for Foreign Economics Administration. He has been appointed to rank of Colonel and granted a leave of absence from Kellogg for period of his special assignment.

Consolidation of A C Horn Co and General Printing Ink Corp has been announced. A C Horn Co will be known as a div of **General Printing Ink Corp.** It is contemplated that the consolidation will change its name to Sun Chemical Corp. A C Horn will become a member of board of directors of General Printing Ink Corp and A E Horn will succeed him as president of A C Horn Co div.

Lincoln Electric Co announces opening of a direct factory branch sales office in St. Louis. It will be under the direction of B J Brugge as welding engineer and district manager of sales and service.

A E Whitney has joined the **Herbert B Davis Co** as vice-president and general sales manager.

A new addition to their factory has just been completed by **Remne Co** for manufacture of their postwar line of unit blowers and fin coils.

Ralph P Walker, with General Petroleum Corp for the past twelve years, has been appointed general sales manager for **Rodpak Mfg Co.**

Appointment of James A Edwards as sales manager of grease dept of **Macmillan Petroleum Corp** was announced. Bob Dunn has been named asst to general sales manager of ring free oil div.

American Foundry Equipment Co has made Morton I Dorfan manager of dust and fume engrg div. In this position he will supervise and coordinate the company's expanded dust control sales, engrg and research activities.

Lesher S Wing and Benjamin H Greene have been appointed by **Federal Power Commission** to regional engineers at San Francisco and Chicago respectively.

David J Guy has been named manager of natural resources dept of **U. S. Chamber of Commerce,** succeeding Walter DuB Brookings, who is retiring from active service after 25 yr, but who is continuing to serve the dept in an advisory capacity.

Clark M Humphreys joins research laboratory of **American Society of Heating and Ventilating Engineers** as senior engineer.

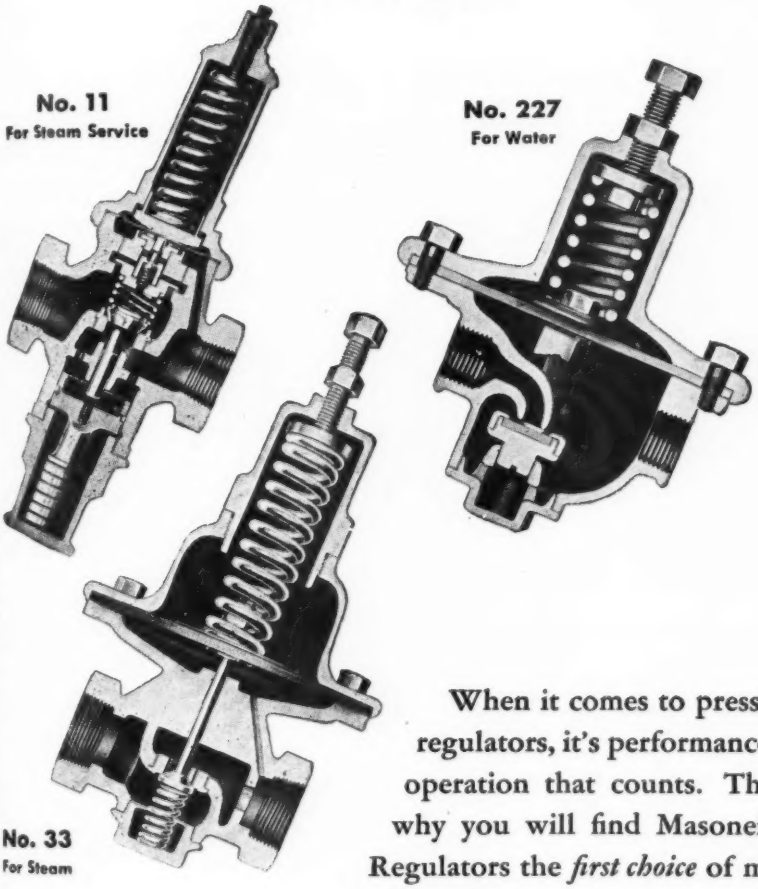
Drexel Institute of Technology elects James Creese president. He has been vice-president of Stevens Institute of Technology since 1928.

Maurice C Taylor has been named resident director of research and development of Niagara Falls laboratories of **Mathieson Alkali Works.** Other research dept changes are as follows: J Douglas MacMahon has been made asst to technical

Performance is the Payoff!

MASONEILAN REGULATORS

Reduce Waste, Require Less Maintenance, Last Longer



No. 11
For Steam Service

No. 227
For Water

No. 33
For Steam

When it comes to pressure regulators, it's performance in operation that counts. That's why you will find Masoneilan Regulators the *first choice* of most operating and plant men. Their experience proves that Masoneilan regulators provide accurate pressure control and save money by reducing waste. In addition, the rugged construction of quality materials reduces maintenance costs to a minimum and assures long regulator life. Catalog 73 gives complete information. Write for a copy today.

MASONEILAN STRAINERS

Prevent scale, dirt, chips, etc. from damaging regulators, traps, valves and pumps . . . use Masoneilan Strainers. These precision-made strainers keep out all foreign matter. They'll eliminate maintenance delays and save you money.

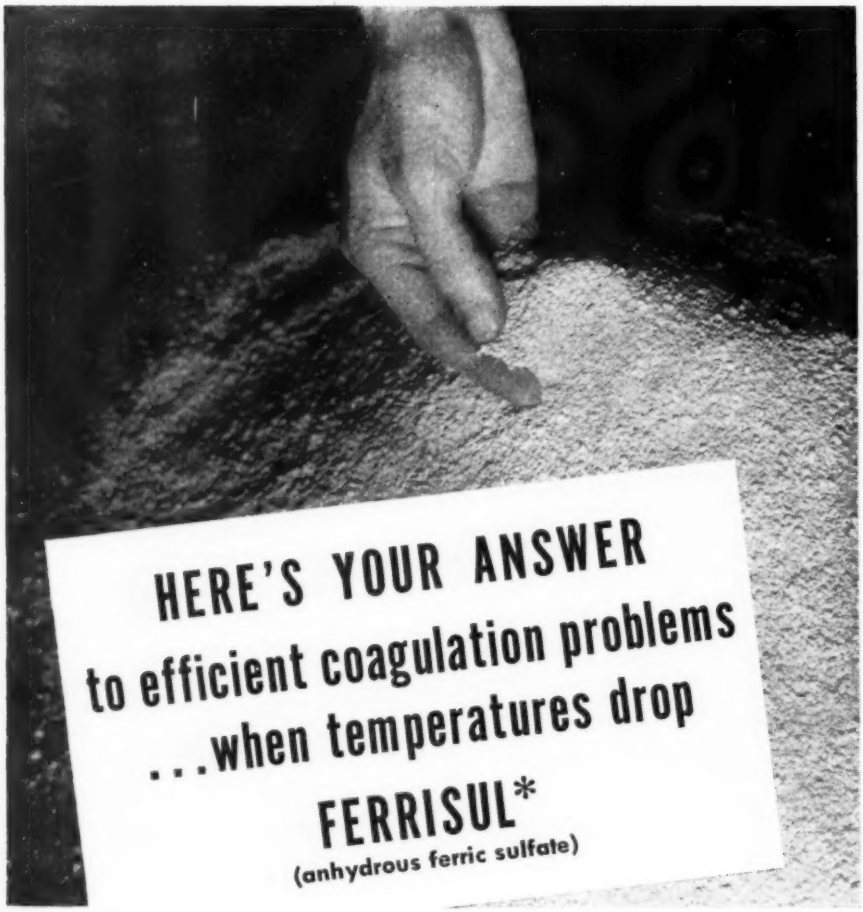
MASON-NEILAN REGULATOR COMPANY
1183 Adams Street, Boston 24, Mass., U.S.A.

New York Philadelphia Pittsburgh Cleveland Chicago Tulsa
Atlanta St. Louis Houston Los Angeles San Francisco
Mason Regulator Co. of Canada, Ltd., Montreal, Canada

Stocked by these Mason-Neilan Distributors

Allen & Reed, Inc., Providence, R. I.
Appleby Bros. & Whittaker, Harrisburg, Penna.
Atlantic Pipe & Supply, Boston, Mass.
Babbitt Steam Specialty Co., New Bedford, Mass.
Barrett-Christie Co., Chicago, Ill.
L. A. Benson Co., Inc., Baltimore, Md.
Berkshire Mill Supply, Pittsfield, Mass.
W. L. Blake & Co., Portland, Me.
Boston Pipe & Fittings Co., Cambridge, Mass.
Braman Dow & Co., Boston, Mass.
Burns Bros., Syracuse, N. Y.
Carolina Supply Co., Greenville, S. C.
W. A. Case & Son Mfg. Co., Buffalo, N. Y.
Chandler Boyd Co., Pittsburgh, Penna.
Coon De Visser Co., Detroit, Mich.
M. J. Daly & Sons, Waterbury, Conn.
Desco Corp., Wilmington, Del.
Dillon Supply Co., Durham & Raleigh, N. C.
J. E. Dilworth, Memphis, Tenn.
J. E. Dilworth, Vicksburg, Miss.
Dixie Mill Supply Co., New Orleans, La.
Morton McI. Dukehart, Baltimore, Md.
Evansville Supply Co., Evansville, Ind.
Fitchburg Plumbing Supply Co., Fitchburg, Mass.
Fleming & Moore, Savanah, Ga.
Galloup Pipe & Supply Co., Jackson, Mich.
Galloup Pipe & Supply Co., Kalamazoo, Mich.
Galloup Pipe & Supply Co., Battle Creek, Mich.
General Fire Ext. Co., Providence, R. I.
Grinnell Co., Atlanta, Ga.
Grinnell Co., Cleveland, Ohio
Grinnell Co., Philadelphia, Pa.
Hajoca Corp., Chattanooga, Tenn.
Hamacher & Williams, Milwaukee, Wis.
Holyoke Valve & Hydrant Co., Holyoke, Mass.
Indianapolis Belting & Supply, Indianapolis, Ind.
The Knapp Supply Co., Muncie, Ind.
Laib Co., Louisville, Ky.
Lang Co., Salt Lake City, Utah
Maintenance Engineering Corp., Houston, Texas
Marsden & Wasserman, Inc., Hartford, Conn.
Mason Equipment Co., Toledo, Ohio
James McGraw, Inc., Richmond, Va.
C. S. Mersick & Co., New Haven, Conn.
Metropolitan Pipe & Supply, Cambridge, Mass.
Chas. Millar & Son Co., Utica, N. Y.
Chas. Millar & Son Co., Binghamton, N. Y.
Chas. Millar & Son Co., Springfield, Mass.
J. J. Morin Inc., Laconia, N. H.
Noland Co., Roanoke, Va.
O'Brien Equipment Company, St. Louis, Mo.
Pennypacker Supply Co., Philadelphia, Penna.
Henry A. Petter Supply Co., Paducah, Ky.
Portland Engineering Co., Portland, Oregon
Providence Pipe & Sprinkler, Providence, R. I.
Reichle Supply Co., Saginaw, Mich.
R. I. Supply & Engineering Co., Providence, R. I.
Root Neal & Co., Buffalo, N. Y.
Ross-Willoughby Co., Columbus, Ohio
San Antonio Machine & Supply Co., San Antonio, Texas
Savannah Ship Chandlery & Supply Co., Savannah, Ga.
Smith Courtney Co., Richmond, Va.
Smith Monroe, South Bend, Ind.
Thos. Somerville Co., Washington, D. C.
Steam Supply & Rubber Co., Seattle, Wash.
Stritt & Priebe, Inc., Buffalo, N. Y.
Textile Mill Supply Co., Charlotte, N. C.
The Henry Walke Co., Norfolk, Va.
Walworth Co., Boston, Mass.
Warren & Bailey Co., Los Angeles, Calif.
Washburn-Garfield Co., Worcester, Mass.
Woodward, Wight & Co., Ltd., New Orleans, La.
Young & Vann Supply Co., Birmingham, Ala.

MASONEILAN



Ferrisul, the only *anhydrous* ferric sulfate available for water and sewage treatment, is therefore the only ferric sulfate which *creates heat* when mixed with water. This means that it is the only ferric sulfate that can be quickly and completely dissolved in cold water by simply adjusting the Ferrisul:water ratio.

If you've experienced the difficulty with ordinary coagulants of getting them into solution during winter months when tap water temperatures are low, you'll appreciate the quick, easy Ferrisul answer to your problem.

For example, if your tap water is 40° F., one part of Ferrisul added to three parts of water will raise the temperature to 92° F. in your mixing pot and the Ferrisul will completely dissolve in about 22 minutes. (We will be glad to send you a complete chart for seven different Ferrisul:water ratios for different temperatures . . . simply use the coupon below.)

**Reg. U. S. Pat. Off.*

Ferrisul has other important advantages that make it preferable for this use, summer or winter:

1. Ferrisul is effective over the entire pH range above 3.5 . . . floc forms rapidly, settles quickly . . . leaves no residuals.
2. Ferrisul is dry and free-flowing . . . easy to store and handle.
3. Ferrisul has a higher ferric sulfate content than any other commercial product . . . particularly important since the efficiency of any ferric sulfate coagulant depends entirely upon its ferric sulfate content.

Use the coupon below for more information about Ferrisul for more efficient coagulation in your plant now. MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Massachusetts.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY
Everett Station
Boston 49, Mass.

Please send me your ☐ chart of curves on Ferrisul:water ratios at different temperatures ☐ other information on Ferrisul water treatment

*Name*_____

*Company*_____ *Title*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

director, C N Richardson manager of research engrg, and C Gerald Day research and plant liaison engineer. Both Mr Taylor and Mr MacMahon will report to Dr G P Vincent, technical director.

CURRENT AWARDS

John E Fast & Co and plants of **North American Philips Co** at Dobbs Ferry and Mt. Vernon, N. Y., have received the Army-Navy "E" award.

Manhattan rubber mfg div of Raybestos-Manhattan, Inc, Milwaukee plant of **Square D Co** and Chicago district plants of **Youngstown Sheet & Tube Co** were awarded third stars.

John Reiner & Co and **Chain Belt Co** have been awarded fourth stars for their "E" pennants.

Handy & Harman and **De Laval Steam Turbine Co** have the fifth stars for their flags.

OBITUARIES

Herman Cope, 64, sales manager of J E Rhoads & Sons, Philadelphia and Wilmington leather belting manufacturers for 45 yr, died at his home near Moylan, Pa. He was a member of the Society of Friends.

W J H Miller, manager of safety valve division, Manning, Maxwell & Moore, Inc, Bridgeport, Conn., died Sept 11 after a protracted illness.

Robert Atkinson, 53, district manager since 1927 of steel and tube div of Timken Roller Bearing Co, Detroit, Mich., died Sept 2 in the Alexander-Blaine hospital.

Frank W Schultz, 84, retired stationary engineer, died recently in his home in Buffalo, N. Y. He was chief engineer of Thompson-Huston Electric Co before he retired in 1929.

Elmer E Gilbert, 78, retired sales manager of General Electric Co's turbine div, died in Schenectady on Aug. 26.

Edward S Rothchild, 53, vice-president and one of two principals of Rodpak Mfg Co, died July 28 at San Mateo, Calif.

Harry M Swigart, 53, president of Oil Gear Co, died recently at Star Lake, Wis.

John B Berryman, 83, chairman of board of directors of Crane Co since 1935, died in Chicago on Aug. 10.

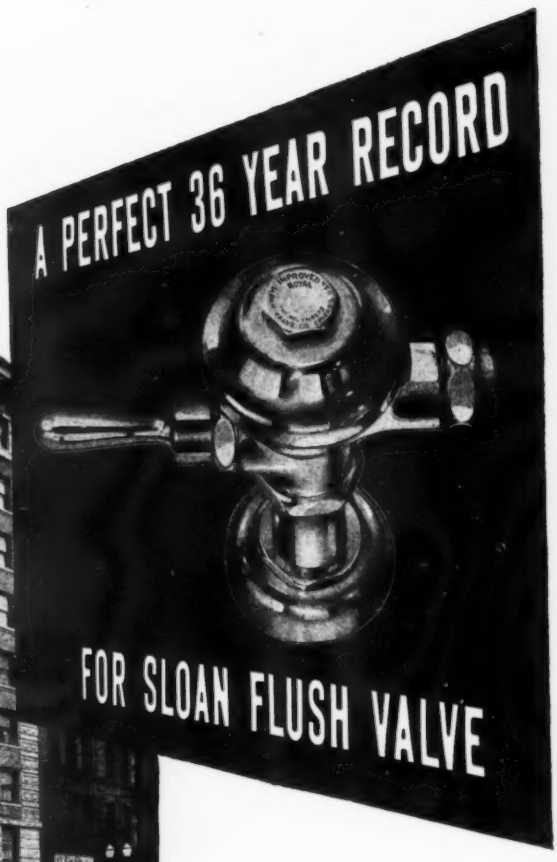
Adolphus Mansfield Dudley, 68, retired Westinghouse Electric Co engineer, died at his home in Oakmont, Pa., on Aug. 16.

William J Collins, 87, retired stationary engineer in the school dept, Buffalo, N. Y., died recently in his Buffalo home.

Horace Burrough, III, 49, asst general manager of sales for Monsanto Chemical Co's Merrimac div, died Aug 8 at his home in Swampscott, Mass.

John Foster Gilchrist, 77, retired vice-president of Commonwealth Edison Co, Chicago, died Aug 4 at his summer home near Mokena, Ill.

Frank Garrity, supervisor of a branch electric power station for New York Central Railroad, Yonkers, N. Y., died recently at his home there at the age of 61.



The IMPERIAL Hotel
THE HOUSE OF PERSONAL SERVICE
BROADWAY AT STARK
PORTLAND 5, OREGON

March 21, 1945

Sloan Valve Company,
Chicago,
Illinois.

Gentlemen:

The Imperial Hotel was built in December, 1909, and has been kept modern. During that period it has been necessary to make important changes, and the hotel has been remodeled three times, but no replacement has ever been necessary in the Sloan Valves which were installed at the time the hotel was built. Dependability of operation over 36 years service and extremely low maintenance costs speak for themselves, to be sure, but to confirm this outstanding performance let me say that Sloan will always be our choice whenever Flush Valves are selected.

Yours very truly,
IMPERIAL HOTEL CO.,
Phil Metschan
Phil Metschan
President.

Sloan Valve Company has been awarded the Army-Navy "E" three times for excellence in production.

"The house of personal service"

The Imperial Hotel, Portland, Oregon, has been remodeled three times since its construction in 1909. This was done in the interest of maintaining the high standards set by its slogan: "The House of Personal Service." Yet—the Sloan Flush Valves which were a part of the original equipment have never been replaced. They are still in perfect operating condition after 36 years of continuous service.

Added to this splendid record of performance is Mr. Metschan's testimony of complete satisfaction. He adds that "Sloan will always be his choice in Flush Valves."

We urge *you* to make inquiry of performance records—water saving records—and maintenance cost records. You will find Sloan Flush Valves *unequalled* on all counts—three of the many reasons why Sloan is the world's most popular Flush Valve.

Yes—there are millions more Sloan Flush Valves in service than all other makes combined.

SLOAN VALVE COMPANY
4300 WEST LAKE STREET, CHICAGO 24, ILLINOIS

HERCULES
SEAMLESS COPPER
FLOATS

GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

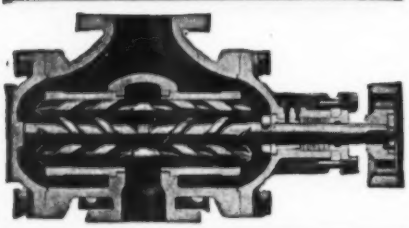
Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

IMO

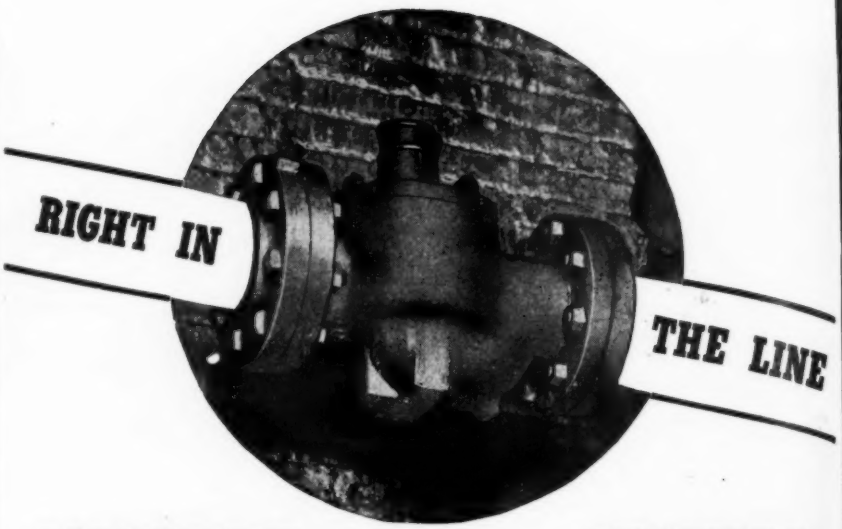


THE PUMP without PULSATION

The steady, uniform flow produced by the continuous turning of the rotors in an IMO pump is ideal for oil burners, hydraulic and other service requiring an even, pulsation-free flow.

For further information, write for Catalog 1 136 P

IMO
PUMP DIVISION OF THE
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

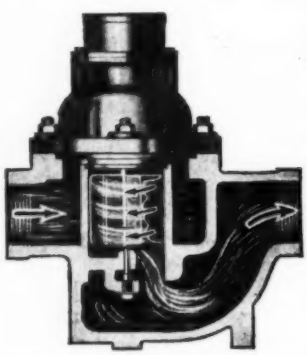


HENSZEY *Feed Water* METERS

can be installed right in the line without additional structural supports. Simplicity of installation, combined with extreme accuracy and rugged construction, make Henszey Meters ideal for the job of measuring Boiler Feed Water, Hot Dirty Blowdown, Condensate, Free Running Chemicals, and other "Hard-to-Measure" Liquids.

Henszey Meters are equally accurate at high or low flow — high or low pressures — on centrifugal or reciprocating pumps. Calibrations can be made to read in gallons, pounds or cubic feet at any specified temperature.

If you have a particularly tough job of measuring that demands accuracy — consider the Henszey Meter. Write for bulletin.



NO CLOSE CLEARANCES

Water enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each gallon that passes through this chamber makes the same number of revolutions of the water. A vane is placed in the rotating water to impart this rotation to the register. A minimum of working parts without close clearances.

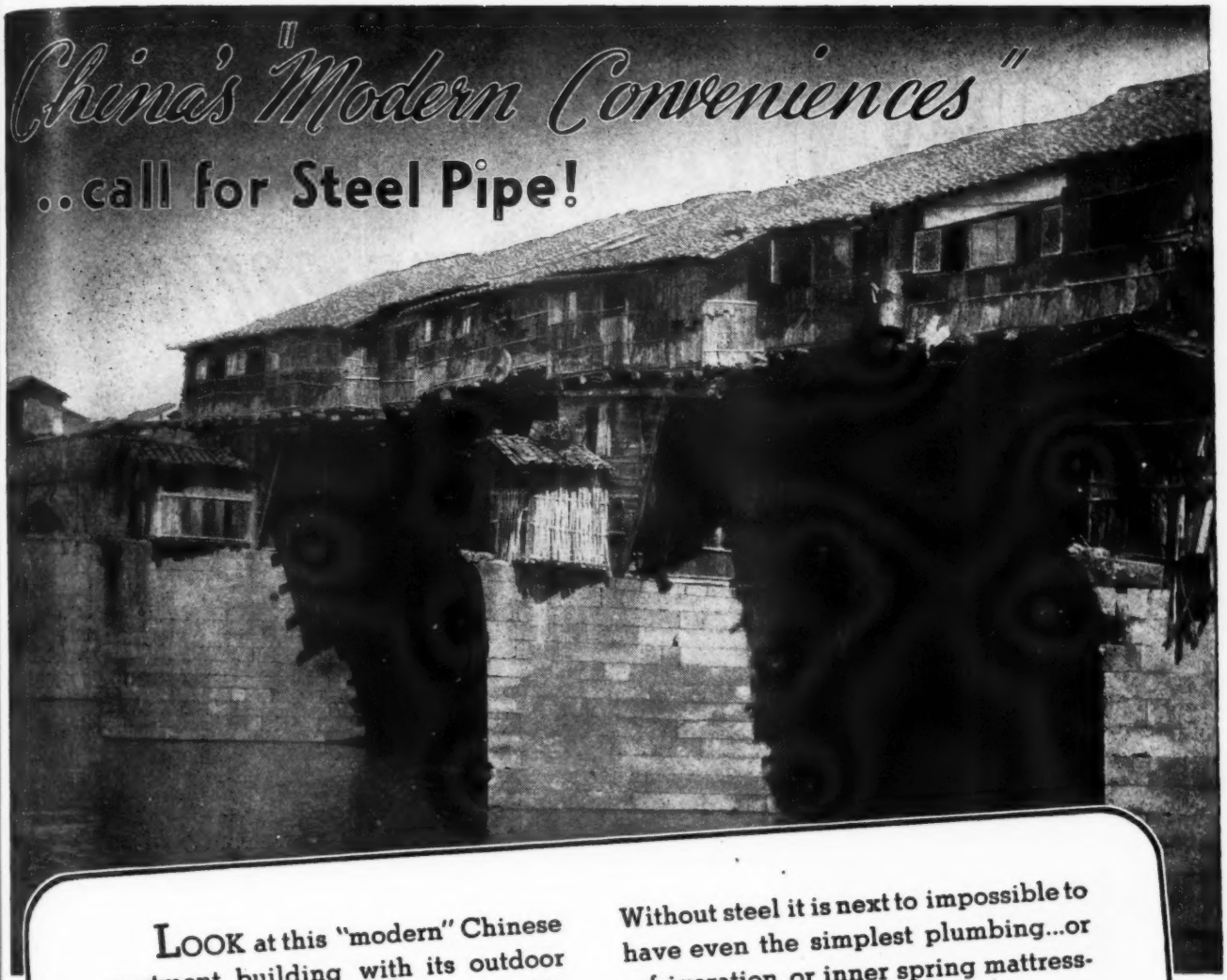
HENSZEY COMPANY
DEPT. D-10 • WATERTOWN, WIS.

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Flow Indicators • Boiler Feed Regulators • Proportioning Valves

China's "Modern Conveniences" ..call for Steel Pipe!



LOOK at this "modern" Chinese apartment building with its outdoor facilities overhanging the river. No doubt every bridge houses similar accommodations. And this same river may provide the water supply for all human needs--garbage disposal, laundry, bathing, drinking.

Oriental housing is so different that we call it "quaint" and "picturesque". We could truthfully describe it as "inconvenient", "uncomfortable", "unsanitary"

Why do the people of the East endure this? Do they prefer to drink unclean water, to wash and bathe in primitive ways?

No, of course, not. You know the answer. Their backwardness is due in large part to lack of steel. Without steel it is next to impossible to have even the simplest plumbing...or refrigeration, or inner spring mattresses, or scores of other household accessories that help make living in America a joy instead of a burden.

America's well-being depends on steel. When war's demand is ended, there will be steel enough for present American homes to be modernized and new ones built...with modern conveniences never even known before.

One way in which we Americans can contribute to lasting peace is to help other peoples of the world to appreciate and enjoy the high standards of living that steel makes possible.

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

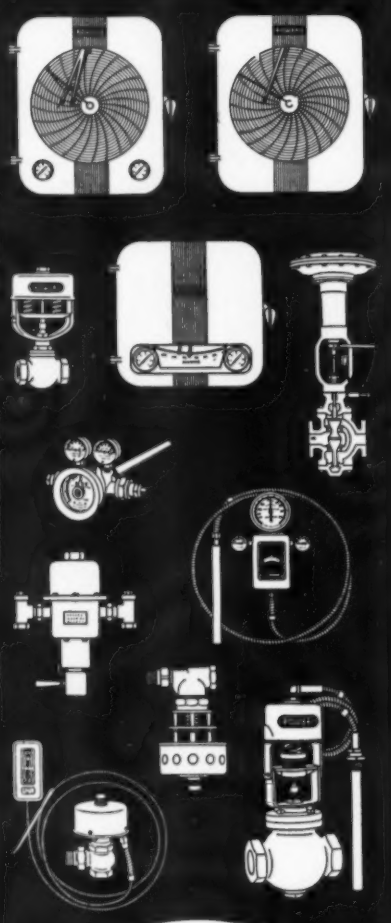
YOUNGSTOWN, OHIO

Manufacturers of

CARBON · ALLOY AND YOLOY STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit-Bars-Coke Tin Plate-Electrolytic Tin Plate-Rods-Wire-Nails-Tie Plates and Spikes.

POWERS
TEMPERATURE and HUMIDITY
CONTROL



When you want accurate and dependable automatic temperature or humidity control for Industrial Processes, Heating or Air Conditioning Systems, call in a Powers engineer. With over 50 years of experience and a very complete line of self-operating and air operated controls we are well equipped to fill your requirements.

Write for Circular 2520
2771 Greenview Ave., Chicago
Offices in 47 Cities—See your phone directory.

THE
POWERS REGULATOR CO.

SAVE SUPERVISION
in fitting
PRECISION PARTS

YOU PROBABLY KNOW Laminum shims as assembly time savers. But have you overlooked the fact that in fitting machine parts by peeling these precision laminations, considerably less supervision is required. You have the certainty of uniform accuracy . . . with no spoilage. Your request for data invited.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated
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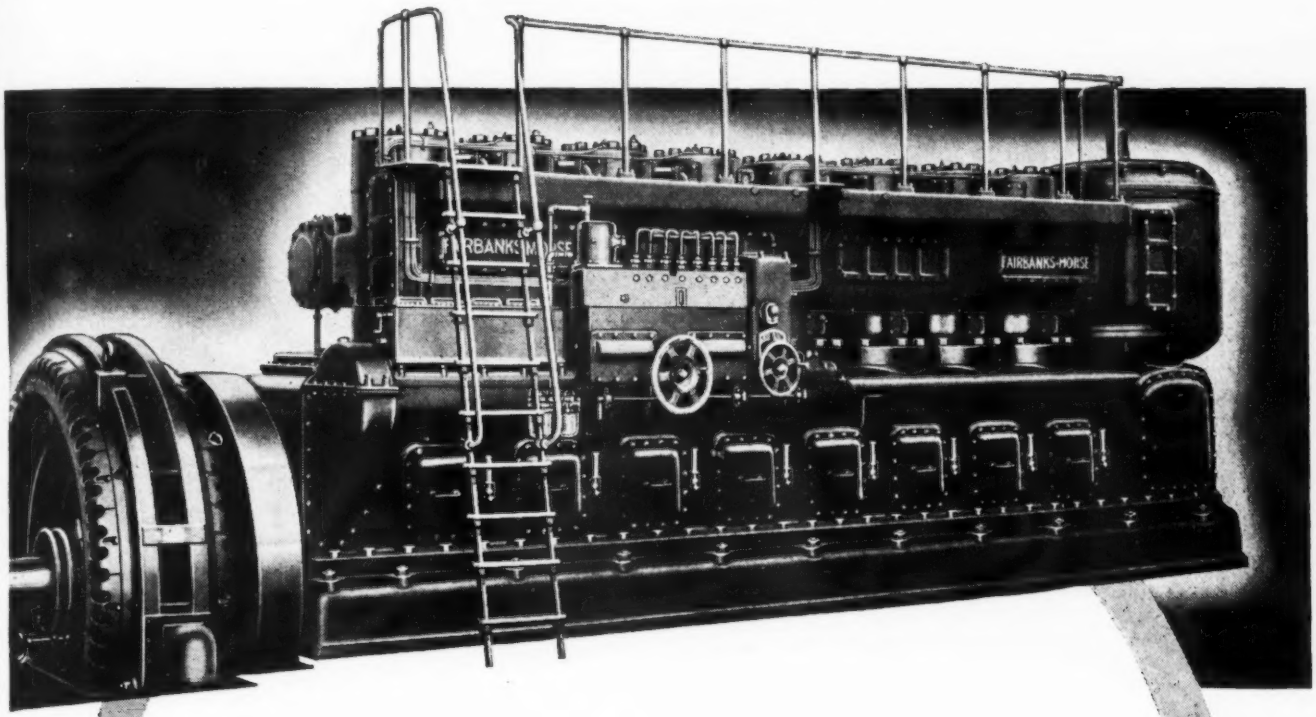
LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

2221

FAIRBANKS-MORSE

A name worth remembering



FAIRBANKS-MORSE is the name to think of first when you need Diesel engines. The performance records of more than five million horsepower of these Diesels prove they have the stamina to stand up in sustained, heavy-duty service . . . that they are built for low maintenance cost as well as low fuel cost.

★ ★ ★

The outstanding performance records of Fairbanks-Morse Diesels have been made in every kind of industrial service . . . under every imaginable condition. These great engines have competed against almost every known source of power and come up first.

If you need power, or if you want power that costs less—applied directly or through Diesel-generator sets—ask a Fairbanks-Morse engineer to study your problem.

BUY AND HOLD MORE VICTORY BONDS

DIESELS

Diesel Locomotives • Diesel Engines
Pumps • Scales • Generators • Motors
Magnetos • Railroad Motor Cars and Standpipes • Stokers • Farm Equipment

FAIRBANKS, MORSE & CO., CHICAGO 5, ILLINOIS

REMOVES SOOT & FIRE-SCALE WHILE BOILERS OPERATE

CHIPPING AND SCRAPING IS UNNECESSARY when you use XZIT. Simply feed XZIT into the firebox while the boilers operate. When thrown on the fire in a furnace it forms a gas which permeates all parts of the boiler, the uptakes, and the stack and has a chemical reaction on the soot and fire scale.

XZIT can be used to extinguish stack fires and to stop sparking. Regular use keeps boilers and stacks clean and free of soot and fire-scale.

Used by all types of merchant and naval ships, XZIT is a proved product. Write for demonstration or order a trial supply. There is an XZIT representative near you.

XZIT FIRE SCALE & SOOT ERADICATOR

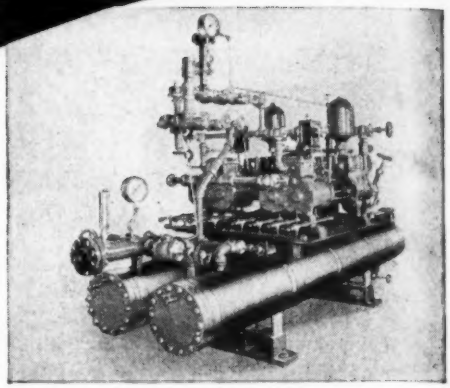
1031 CLINTON STREET, HOBOKEN, N. J.
5800 S. HOOVER, LOS ANGELES, CALIF.

Enco Automatic OIL PUMPING AND HEATING SYSTEM

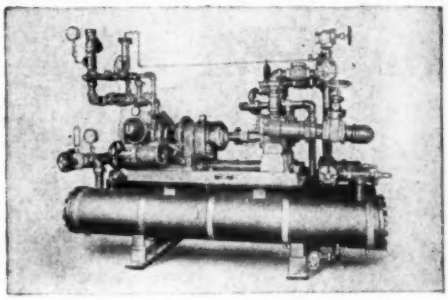
Completly Coordinated

Every detail part of an Enco Automatic Oil-Heating-and-Pumping Unit System is designed, assembled, checked and tested to make sure that it functions as an element of a completely coordinated unit. The sizes of pipes, fittings, valves and other elements are correctly proportioned for the efficient, dependable operation of the unit as a whole. All hand controls are visible and within reach of the operator for quick starting, stopping or cross-over reconnections between duplicate heaters and pumps. Adjustments and cleaning are similarly simplified.

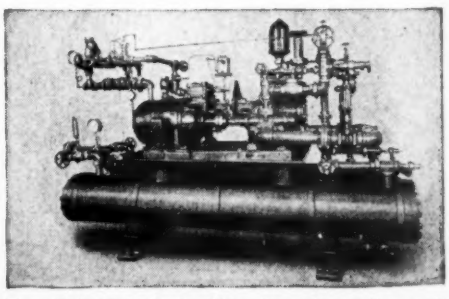
Single or duplicate heaters and electric or steam-driven pumps are used. Interconnected duplicate units give full capacity with either pump or either heater. Capacities range from 100 to 5000 G. P. H. of heavy bunker oil.



Two Horizontal Duplex Piston Type Steam Pumps and two fuel oil heaters—capacity 15 G. P. H. at 250 lb. pressure with either pump or heater.



One Turbine and One Motor Driven Pump and two fuel oil heaters. Capacity 30 G. P. H. at 150 lb. pressure with either pump or heater.



One Horizontal Duplex Piston Type Steam Pump and one Motor Driven Pump and two fuel oil heaters. Capacity 20 G. P. H. at 300 lb. pressure with either pump or heater.

BULLETINS ON REQUEST

OB-37 On oil burning, pumping and heating equipment.

OB-38 Instruction book on care and operation of oil-burner installations.

THE ENGINEER COMPANY
75 WEST STREET Enco NEW YORK 6, N.Y.

New COMPLETE *Catalog*

One DEPENDABLE *Source*

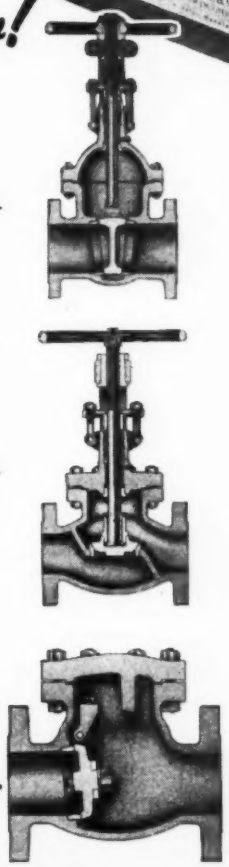
SEND FOR IT *Now!*

OIC

GATE

GLOBE AND ANGLE

SWING CHECK



This CATALOG IS DIFFERENT

THE NEW 1945 Edition of the OIC Steel Valve Catalog *tells all* on Steel Valves . . . gives you complete technical information in concise, time-saving form. Helps you to find quickly the *right* OIC Valve for every application and the correct trim to insure the best performance.

Forty-four pages packed with useful, authoritative data for every user of steel valves. You will find, listed and described, *complete* valve service from *one* dependable source backed by 62 years of experience and seasoned judgment in quality valve manufacture.

WRITE TODAY for copy of the new OIC Steel Valve Catalog. There is no obligation.

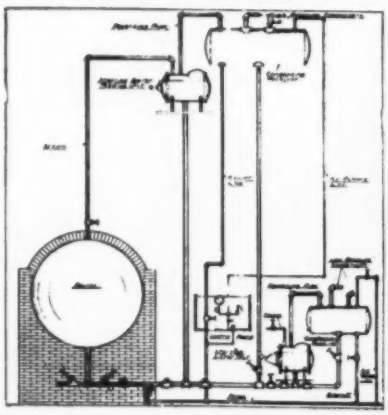
THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883

Sterling

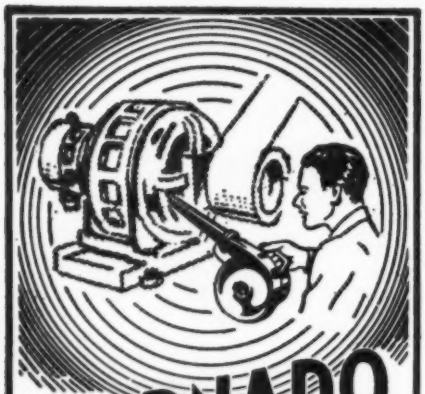
Lifting — Pumping — Boiler Feeding — Vacuum Creating and Vacuum Draining Units



The Exclusive Sterling Closed Condensate Return System saves you FUEL . . .

It retains the condensate temperature, sending it back to the boiler room under pressure without venting to the atmosphere. Only a nominal line drop in temperature giving maximum efficiency, economy and reducing boiler maintenance.

Sterling Engineering & Mfg. Corp.
TEMPLETON MANUFACTURING CO.
110 Business St. Hyde Park 36, Mass.



TORNADO
PORTABLE ELECTRIC BLOWER

reduces DUST DANGER

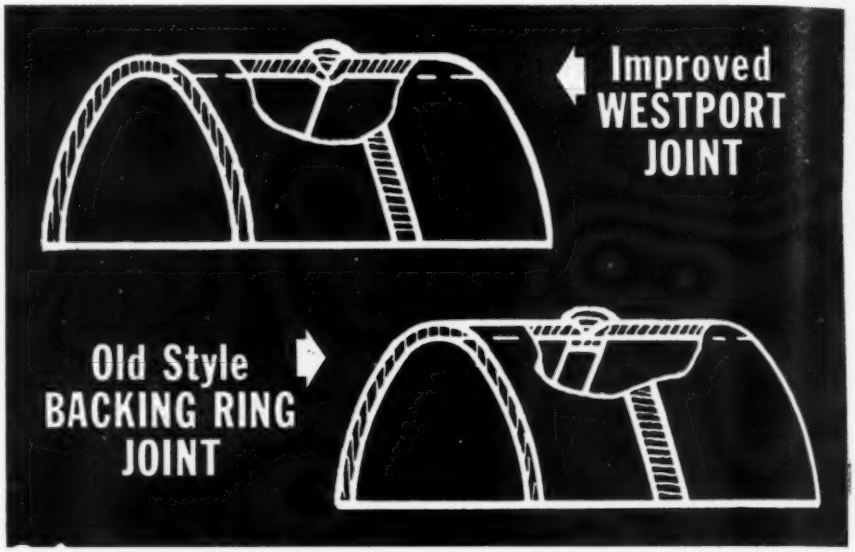
BLOWS clean, dry air, at 295 m. p. h. Cleans out motors, generators and hard-to-get-at places—removing dust, dirt, lint and chips. Costs less than 3c. an hour to operate. Reduces damage to motors and bearings—lessens fire and health hazards.

1 H. P. universal G. E. motor. Weight, 14 lbs. Portable to any place in plant. Plugs in at convenient outlets. Adaptable as Sprayer for spraying paint and insecticide. Convertible into powerful industrial Vacuum Cleaner—for cleaning floors, walls, ceilings.

Free Trial—Write to
BREUER ELECTRIC MFG. CO.
5114 N. Ravenswood Ave., Chicago 40

TORNADO

YOU STRENGTHEN YOUR PIPING WITH THE RIGHT KIND OF WELDS . . .



THE RIGHT KIND OF WELD is the *sound* weld. And, because the Westport Patented Joint welding permits fusion buttwelded joints to be made from one side only, with complete penetration at the root of the weld, this new method is highly successful and popular.

Especially suitable is the welding of heavy wall piping for high pressure temperatures.

Westport Welded Joint Features:

(1) Greater flexibility in alignment of pipe, valves and fittings.

(2) Complete penetration at root of the weld.

(3) No construction in pipe area due to Backing Rings.

(4) No sacrifice in strength of the pipe due to removal of wall or Backing Ring.

(5) Smooth pipe contour at base of weld with no "icicles" or protrusions.

(6) Meets A.S.M.E. Standards.

ENGINEERS' NOTE:

DO YOU HAVE ANY PIPING PROBLEMS WE MIGHT BE ABLE TO HELP YOU SOLVE?

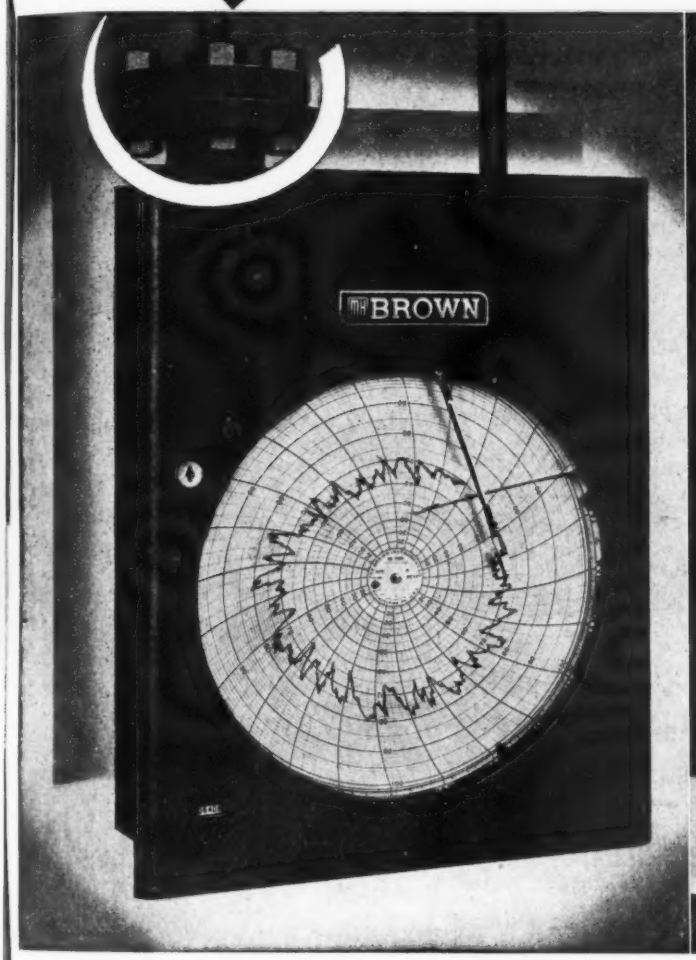
All types of prefabricated piping jobs are today being done by W. K. Mitchell & Co. Years of piping research and experience has taught us the solution to piping troubles. If we can be of help, please call on us. Our Engineers are always at your service.

Write for Bulletin and Descriptive Data

W. K. MITCHELL & CO., INC.
PHILADELPHIA 46, PENNA.

1899 1945

INTERCHANGEABLE



INTERRELATED RANGE TUBES

THE easy range-changing feature of the Brown Mechanical Flow Meter has proved to be of great advantage to users.

If the original flow estimate is found in error (as it is in many cases) or if the average rate of flow changes (as it frequently does), the orifice need not be disturbed, nor another meter body installed to obtain the required range. With the Brown Mechanical Flow Meter all that is required is to install a *new range tube* of proper size in the meter body and use a chart of matched range in the recorder.

Range tubes make range changing easy—quick—inexpensive—no shutdowns or loss of records. Seven interchangeable range tubes make it possible to get a four to one change in meter capacity in steps of roughly 25 per cent.

With Brown Flow Meters, you can correctly determine the cost of making steam for power, processing or heating and properly allocate costs to departments or units. Brown Flow Meter chart records show the rate of steam flow which enables operators to maintain the most efficient boiler operation, thus effecting substantial fuel savings.

Write for Catalog 2204, THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4490 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities, 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

BROWN FLOW METERS
. . . MINNEAPOLIS - HONEYWELL CONTROL SYSTEMS . . .

ROTO Tube Cleaners

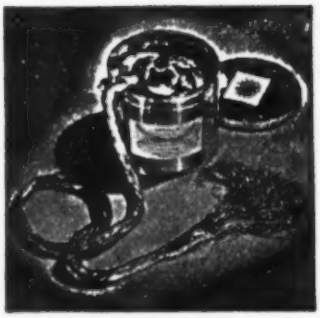
Especially handy inside drums and other tight spots

ROTO
Air Valve

With a Roto Tube Cleaner your operator doesn't have to worry about a helper to turn air on and off. The operator himself controls the entire operation with an air valve located directly behind the motor. You will appreciate the benefits of one-man control because it provides safer, more efficient tube cleaner operation, especially inside drums and other tight spots. Write for details.

Roto Division of Elliott Company
145 Sussex Avenue, Newark 1, N. J.

EUREKA "AMBEST" METALLIC PACKING



Keeps Good Rods Tight Without Scratching

Made of long pliable strands from anti-friction metallic alloy, lubricated and graphited—a universal packing wherever rods are in good condition—suitable for all pressures and temperatures up to 550° —lasts indefinitely.

One size which can be separated for use on any size rod or valve stem.

Send for sample for trial. Ask for 36-p. EUREKA PACKING CATALOG covering complete line.

PATENTED "EUREKA" TRADE MARK

EUREKA PACKING CO., 294-296 - 46th St. Brooklyn 20, N. Y.

Government-owned Equipment MUST BE RUST-PROOFED BEFORE LAY-UP

Remember—you are required to rust-proof all Government-owned production equipment immediately upon termination of your war contract.

Only rust-proofing products accepted under Ordnance Specification P. S. 300-4 are approved for this purpose. TECTYL is so approved and there is a TECTYL product to meet every requirement.

TECTYL seals out moisture, protects against rust and corrosion for as long as two years—indoors and out. A little TECTYL covers a lot of metal.

Don't overlook the value of TECTYL as a rust and corrosion preventive on your peace-time products. Used on materials-in-process and completed units, TECTYL can prevent serious losses from spoilage.

Write today—tell us your corrosion problem and we'll send you a Tectyl bulletin with complete application data.

TECTYL *STOPS RUST*

VALVOLINE OIL COMPANY
431 Main St., Dept. 29 J, Cincinnati 2, Ohio
Refinery at Butler, Pennsylvania
General Offices, Cincinnati, Ohio
New York-Atlanta-Pittsburgh-Chicago-Detroit
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PACKING
THAT EXPANDS AND CONTRACTS

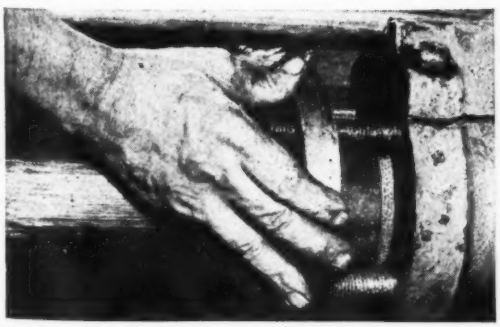
A special cross-expansion packing—U. S. PEERLESS—was developed by United States Rubber engineers to insure a positive seal when reciprocating rods become worn, shouldered, scored or fluted.

Its construction—of diagonally-laid plies of woven duck—permits a "sliding" action on a 45° angle of the individual plies which automatically compensates for the unevenness of the rod.

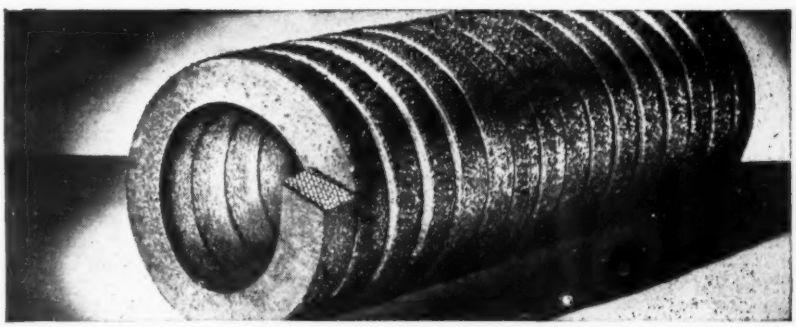
Carefully checked records of this U. S. PEERLESS CROSS EXPANSION PACKING have verified every claim of satisfactory packing performance against medium or low-pressure steam, hot or cold water, ammonia, alcohol, light and mineral seal oils.

It is another example of the benefits gained by applying exact rubber technology to the practical needs of industry.

SERVING THROUGH SCIENCE



PACKING QUICKLY REPLACED—Available in sizes ¼" to 1½" inclusive, U. S. PEERLESS CROSS EXPANSION PACKING is applied quickly and easily. Furnished in spiral, coil or ring form.



U. S. PEERLESS CROSS EXPANSION PACKING—("U. S." Style No. 231) is made of diagonally laid plies of highest quality closely woven duck, bonded together with a special "U. S." rubber compound and thoroughly lubricated and graphited. It has excellent aging qualities.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N.Y. • In Canada: DOMINION RUBBER CO., LTD.

Make Your Overhead Valves SAFE And Easy to Reach---

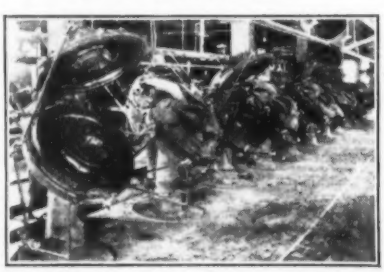
With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

THERE IS A FLEXO JOINT FOR EVERY PURPOSE

No matter how hard the service may be, the uses for FLEXO JOINTS are limited only by the applications to which they can be put in your plant. Send us a brief description of your requirements as we undoubtedly have a record of a similar installation. FLEXO JOINTS are used on pipe lines that are moved or swung in different directions or on machinery or equipment that must be supplied with any fluid while in motion.

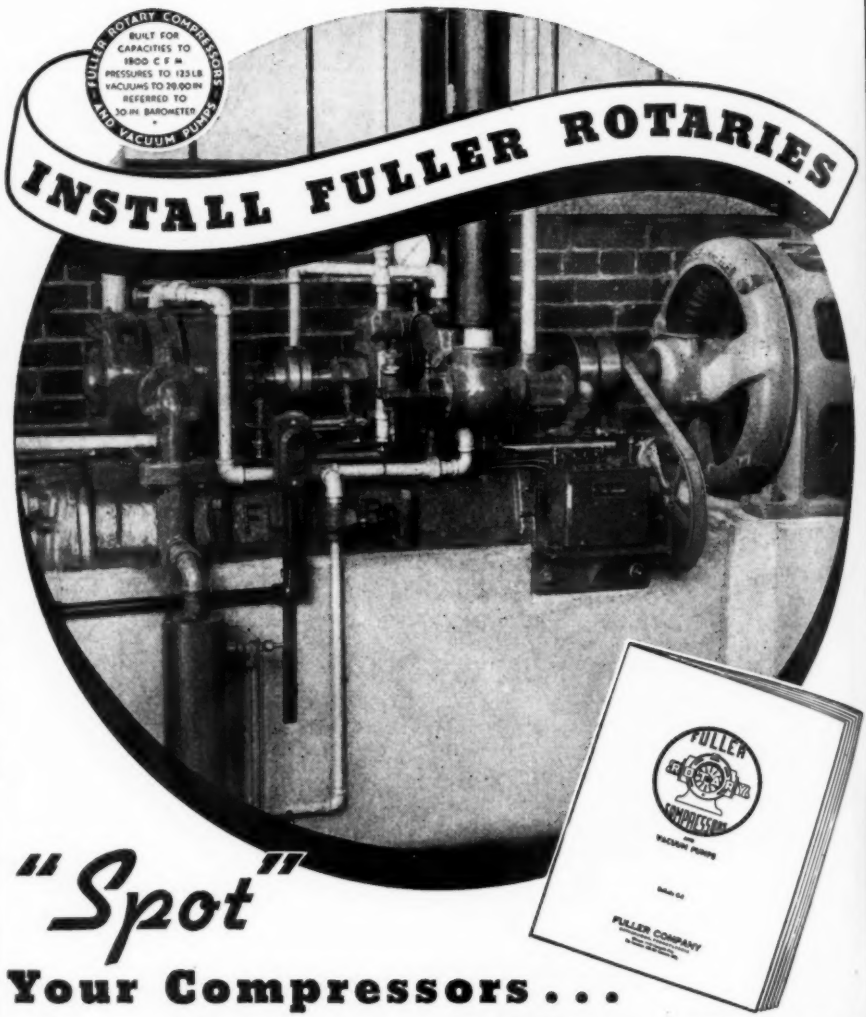
Made in 4 styles in all iron pipe sizes from ¼ inch to 3 inches. All pressures to 1350 lbs. superheated steam.



Inner tube vulcanizers. Steam is supplied to the upper and lower half of the molds by using pipe and FLEXO JOINTS.

Write for prices and discounts

FLEXO SUPPLY COMPANY, Inc.
4224 Olive Str. St. Louis (8), Mo.


FULLER ROTARY COMPRESSORS
BUILT FOR CAPACITIES TO 5800 C F M PRESSURES TO 125 LB VACUUMS TO 29.00 IN REFERRED TO 30 IN BAROMETER
AND VACUUM PUMPS
INSTALL FULLER ROTARIES
FULLER
COMPRESSORS
AND
VACUUM PUMPS
FULLER COMPANY

"Spot" Your Compressors . . . Air . . . Where and When Needed

This is the fifth and last of a series in which we have endeavored to set forth some of the outstanding qualifications and advantages of the Fuller Rotary Compressor. Necessarily our story in these advertisements had to be very brief.

We should welcome the opportunity to discuss advantages for your plant to: *"Spot your compressors . . . have your air when, where and as you need it."* We have every reason to believe you will profit by such an installation, as many others have done in the past few years.

The installation shown above proves our point . . . a two-stage compressor which was operated 23 hours per day for four years, and not one cent was spent for repairs or replacements.

Bulletin C-5 illustrates and describes these machines. It's yours for the asking.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

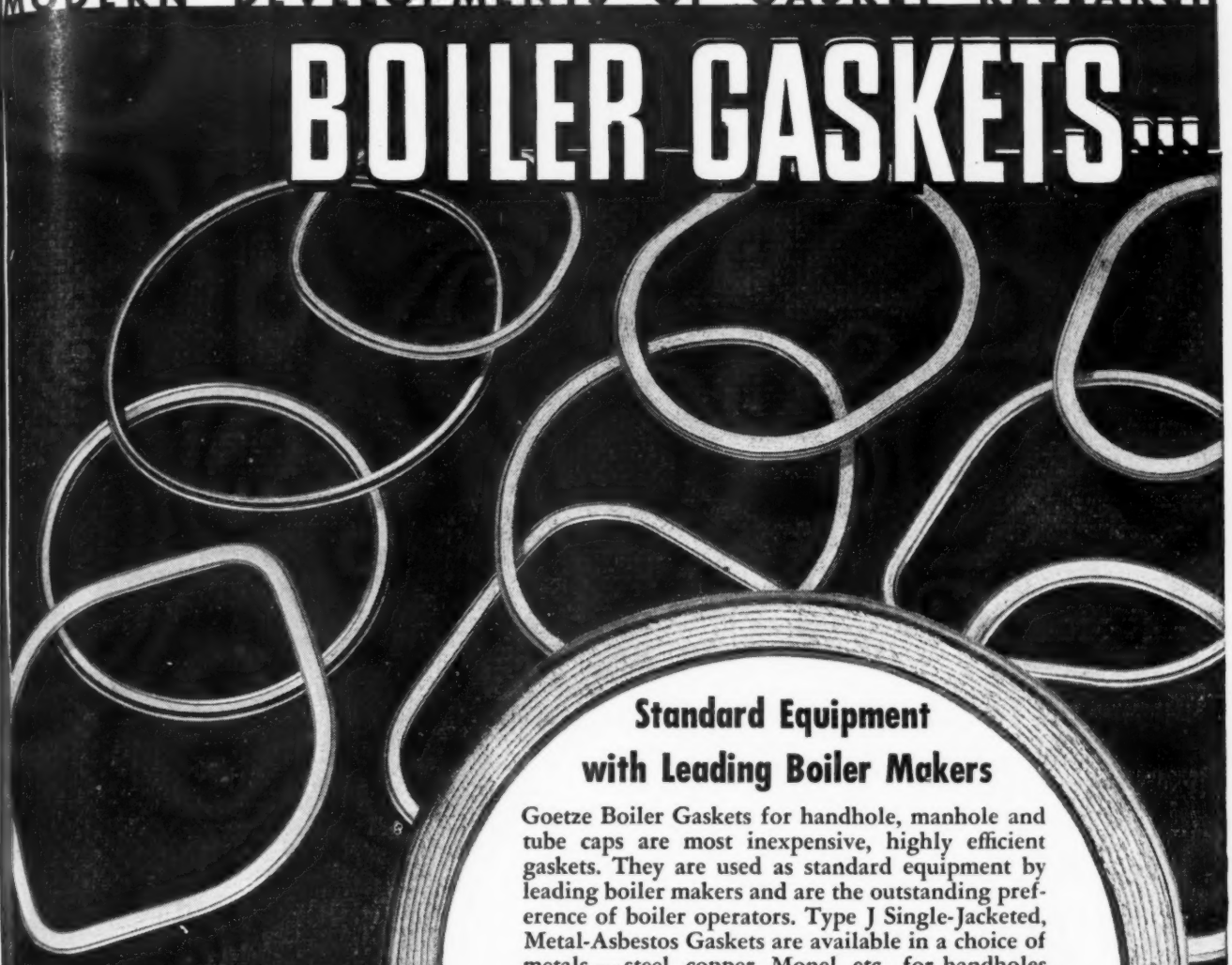
Chicago 3 · 1144 Marquette Bldg.
San Francisco 4 · 421 Chancery Bldg.
Washington 5, D. C. · 618 Colorado Bldg.

C-113

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

MODERN DEVELOPMENTS OF GASKET RESEARCH

BOILER GASKETS...

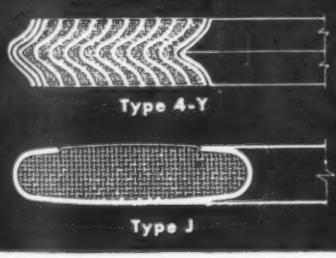


Standard Equipment with Leading Boiler Makers

Goetze Boiler Gaskets for handhole, manhole and tube caps are most inexpensive, highly efficient gaskets. They are used as standard equipment by leading boiler makers and are the outstanding preference of boiler operators. Type J Single-Jacketed, Metal-Asbestos Gaskets are available in a choice of metals — steel, copper, Monel, etc., for handholes and tube caps.

Goetze Type 4-Y Spiralwound — an improved Metal-Asbestos Gasket composed of interlocking plies of preformed metal, cushioned with asbestos strip and spirally wound, possesses unusual resilience — makes and maintains a perfect seal, even on badly-warped or pitted surfaces. This type is remarkably strong, highly resistant to corrosion and temperature, may be reused a number of times.

Made in plain or zinc coated cold-rolled low carbon steel and 18-8 Stainless Steel in round, oval or irregular shapes for manholes, handholes and tube caps.



Technical Bulletins Available

Ask to have your name added to the list of engineers receiving "The Gasket" — a series of technical bulletins containing original gasket data emanating from the Goetze Research Laboratory. Write on your company letterhead giving your position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, N. J.

Boston New York Philadelphia Pittsburgh
Cincinnati Cleveland Detroit
Houston San Francisco Chicago
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Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

GET 100 CENTS VALUE FOR YOUR STEAM DOLLAR . . .

Swendeman's 30 years Experience and Study Have Developed A Steam Trap Whose Sturdiness, Simplicity and Dependability Produce Results--WHICH ARE DIRECTLY REFLECTED IN YOUR *FUEL COST*.

These continuous discharge Traps *have no time lag* and their capacities and efficiencies exceed the intermittent design.

Pick out a tough spot in your plant and let the Swendeman prove it. Write today.

SWENDEMAN, Inc.
171-175 Camden St., Boston 18, Mass.

ADAMANT
FIRE BRICK CEMENT

. . . WELDS BRICKWORK TOGETHER
Use ADAMANT for strong, gas-tight joints that will not shake loose from vibration and will effectively resist the abrasive action of dust laden gases . . . for strong, thin joints that are strong as the brick they bond. Longer life of furnace linings means savings in maintenance costs.
"Its Strength Increases as Temperature Rises"

ADAMANT has a bonding strength of 800 pounds per square inch at room temperature and 1270 pounds per square inch at 2600° F. ADAMANT has a P. C. E. of 3000° F. Plus.

This exceptional bonding strength is the reason why ADAMANT keeps furnace linings in service longer. Write for further details.

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

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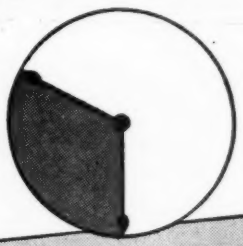
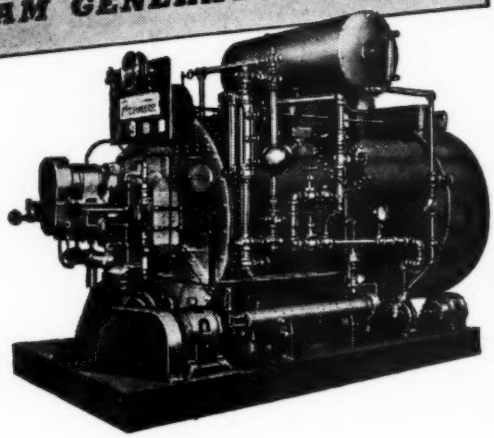
"DELIVERED AT 6 P. M. -FULL STEAM PRESSURE BY TEN!"



That's the kind of installation records being made by this new O & S "packaged" power plant . . .

Powermaster
STEAM GENERATING UNIT



● All the equipment you need for fast steam generation is combined in this one fully-automatic unit. Delivered ready to use!

Wired, mounted, with oil burner, controls and condensate return *built in,* the Powermaster delivers full pressure from cold water in a matter of minutes. And no stack is needed for draft.

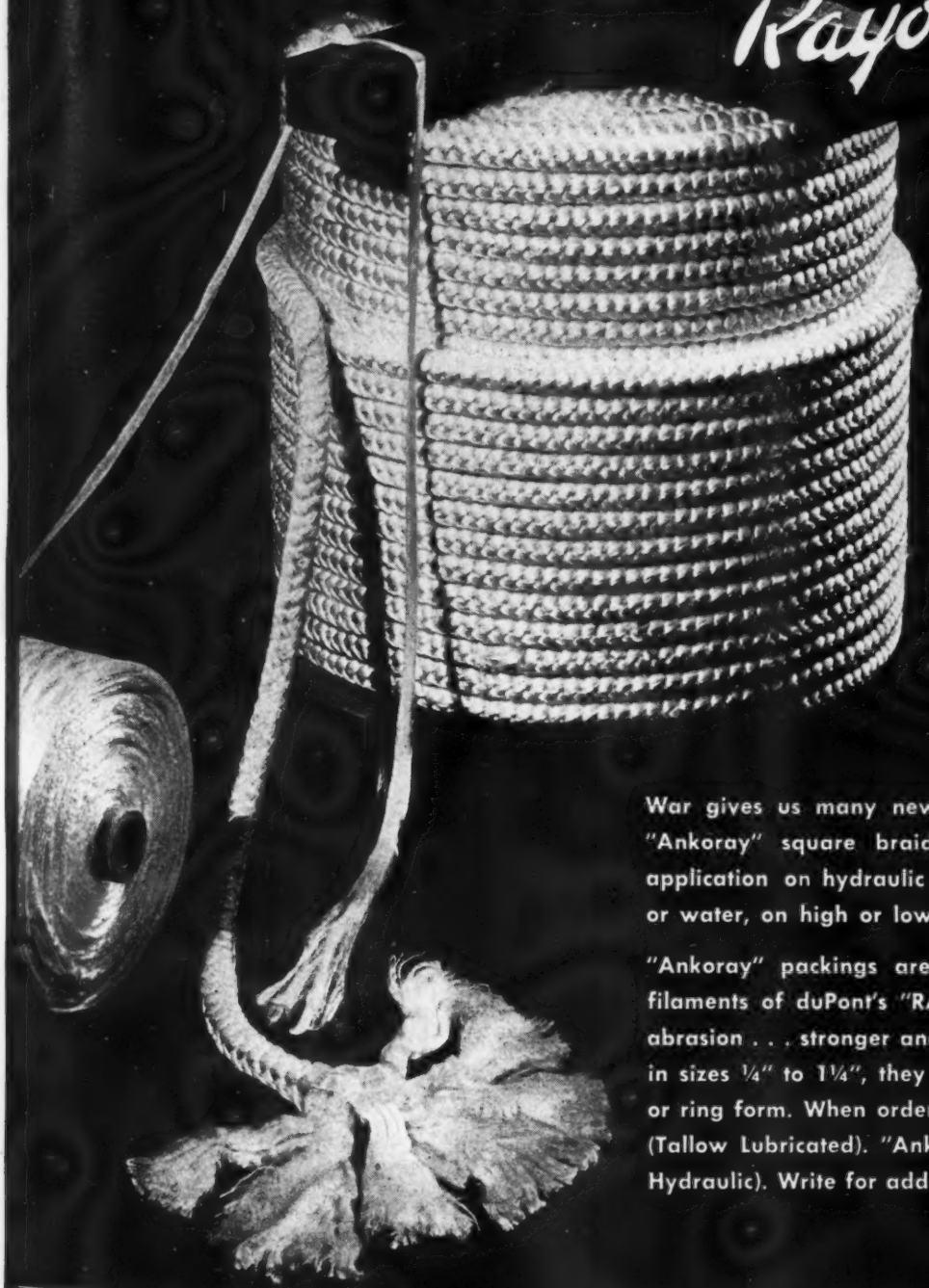
One *source* for the complete unit . . . one *responsibility* for quick installation, efficient operation and dependable service!

GET A POWERMASTER UNIT . . . or bulletin for further information from Orr & Sembower, Inc., 974 Morgantown Rd., Reading, Pa.

*T. M. Reg. U. S. Pat. Off.

ORR & SEMBOWER INC.
READING O&S PENNA.
Builders of Better Boilers Since 1885

"Ankoray" PACKING FABRICATED FROM "Rayon Fiber"



THE ANCHOR PACKING CO. TRADE MARK

War gives us many new and better products. The new "Ankoray" square braided packings are finding wide application on hydraulic equipment working against oil or water, on high or low pressures.

"Ankoray" packings are made from strong, continuous filaments of duPont's "RAYON No. 126" . . . are low in abrasion . . . stronger and softer than rawhide. Fabricated in sizes ¼" to 1¼", they are furnished on reels or in coil or ring form. When ordering specify "Ankoray" No. 332-T (Tallow Lubricated). "Ankoray" No. 332-WPH (Waterproof Hydraulic). Write for additional information.

VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

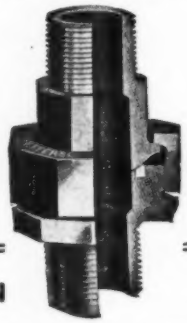
BRANCH OFFICES

...more, Maryland,	106 Stewart Bldg., Gay and Lombard Streets
...n, Massachusetts	303-04 North Station Building
	150 Causeway Street
...alo, New York	Andrews Building
...land, Ohio	523-25-27 Rockefeller Building
...nbus, Ohio	172 North CassinghamRd.
...igo, Illinois	200 East Illinois Street
...nnati, Ohio	4 West 7th Street
...it, Michigan	169 West Jefferson Avenue
...ton, Texas	509 Washington Avenue
...s City, Missouri	1332 Oak Street
...Angeles, California	720 Mateo Street
Montreal, Canada	5575 Cote Saint Paul Road
Milwaukee, Wisconsin	4417 West North Avenue
New Orleans, Louisiana	418 Common Street
New York, New York	100 Sixth Avenue, near Canal
Philadelphia, Pennsylvania	401 North Broad Street
Pittsburgh, Pennsylvania	405 Penn Avenue
Portland, Oregon	Terminal Sales Building
San Francisco, California	156 South Park
Seattle, Washington	2207 First Avenue, South
St. Louis, Missouri	1407 Pine Street
Tulsa, Oklahoma	823 South Gary Place
Wilmington, California	207 Avalon Boulevard

JEFFERSON

Specialty Unions

. . . with the



Recessed Brass Seat

SIMPLIFY APPLICATION **SAVE PIPE JOINTS**

Jefferson All Male Unions offer many opportunities for time savings in making up pipe joints. They are far easier to apply and can be depended on to maintain tight, leakproof installations.

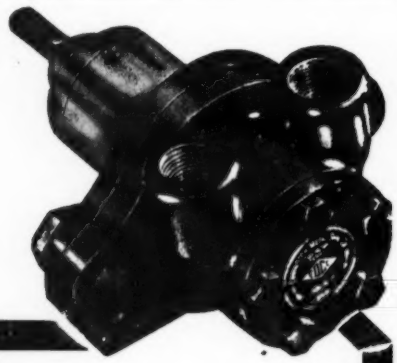
This type Jefferson Specialty Union assures great convenience when a union is required between two female threaded parts, such as between a check valve and a globe valve on boiler feed lines. It is also recommended for installation between a valve and a threaded receptacle having female pipe threads. In such installations, two pipe joints are saved with resulting improvement in the piping system. A wrench of any width face may be used for making up the joint.

Jefferson All Male Unions feature the exclusive Jefferson Recessed Brass Seat which, located out from the runway of the fitting, assures free, unrestricted flow through the straight bore of the fitting.

Get in touch with your nearest distributor or write us direct for complete details of the Jefferson line.

JEFFERSON UNION CO.
601 WEST 26TH STREET, NEW YORK 1, N. Y.
Factories at
LEXINGTON 73, MASS. **LOCKPORT, N. Y.**

EDCO ROTARY PUMPS



VANE TYPE
PATENTED CONSTRUCTION

At high or low speeds . . . whether creating a 28" vacuum or developing extremely high pressures . . . the vanes of EDCO Pumps maintain effective spanning position without springs or centrifugal action.

Fuel transfer pumps, coolant pumps and motor-driven assemblies. Furnished in capacities from 2 GPH up, in any required corrosion-resisting material. Operates silently at all speeds. Minimum maintenance required. Used for fuel oils and other fluids of any specific gravity.

FOR COMPLETE DATA . . . write today. Ask for Bulletin 936.

EDDINGTON METAL SPECIALTY CO.
P. O. Box K **Eddington, Pa.**

Remember

these two points on

Saverite

REFRACTORY COATING

1. **It prevents failure of refractories**
2. **It reduces heat losses; cuts fuel bills**

Saverite Refractory Coating consists of fusible clays which take on a ceramic set at 1400 degrees F. and glaze at 1900 to 2100 degrees F. It penetrates brick pores, cracks and joints, welding them into a monolithic wall—preventing spalling or slag build-up, thus increasing the life of a refractory. The glazed surface of Saverite Refractory Coating reflects heat back into the furnace, effecting savings in fuel. Application is by brush or spray gun.

Saverite
ENGINEERING COMPANY

1030 Willow Avenue, Hoboken, N. J. — 5800 So. Hoover Street, Los Angeles 44, Calif.

For Additional Details Mail This Coupon Today

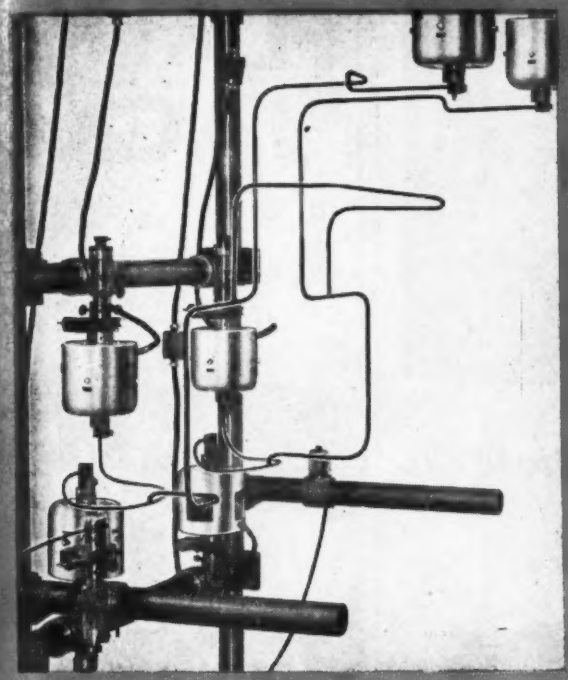
SAVERITE ENGINEERING COMPANY
1030 Willow Avenue
Hoboken, N. J.

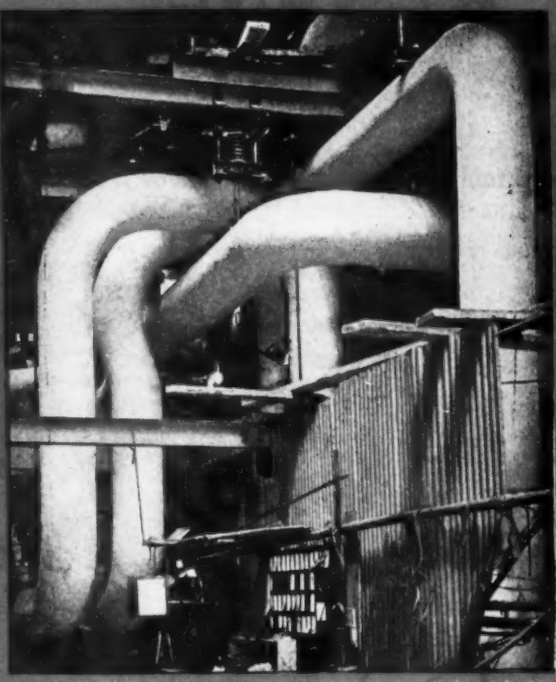
Please send me your folder on "Saverite Refractory Coating."

NAME _____

ADDRESS _____

CITY _____ STATE _____





KELLOGG

PIPING PROBLEMS
are Solved in Advance in the
KELLOGG LABORATORIES

Extremely accurate stress analysis of scale models, using electrical strain gauges, measuring load deflections to one millionth of an inch, enables Kellogg to furnish piping systems with complete assurance that they will perform as required when the plant is put in operation.

The "bugs" are thus found and eliminated even before the final drawings are allowed to go to the shop. This *design research* explains the acknowledged superiority of KELLOGG pipe installations. This is an exclusive Kellogg service available to consulting, power, process and marine engineers.

KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

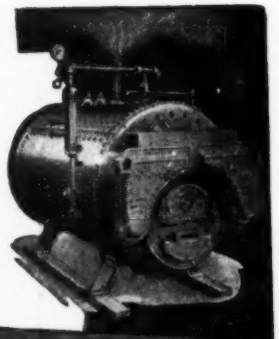
LOS ANGELES: 609 SOUTH GRAND — HOUSTON 2, TEXAS: 402 ESPERSON BLDG. — TULSA: PHILTOWER BLDG

KEWANEE

SCOTTIE JR BOILER

5 sizes for small industrial usage. 9.9 to 30 H.P. Conveniently compact, yet easily accessible. Low in cost—economical to operate.

75 Years Boilermakers



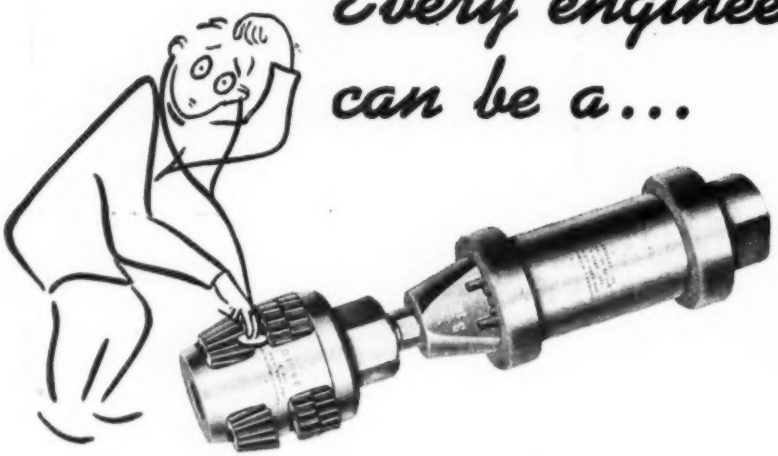
For 6" scale with pipe diameter marking, write Department 99-K10

KEWANEE BOILER CORPORATION Kewanee, Illinois

High Pressure Steam at Low Cost

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

Every engineer can be a...



...TUBE CLEANER DOCTOR

You don't have to be a regular M.D. to doctor your sick tube cleaners. You can lengthen the life and increase efficiency of most war-weary tube cleaners—if you know how. It's simple when you have a copy of the WILSON TUBE CLEANERS CHECK-LIST.

This valuable six-page folder contains a list of hints on tube cleaner maintenance and operation that will help you get better service from your tube cleaning equipment.

In addition, the CHECK-LIST contains a two-page selection guide that will enable you to choose the exact cutter-heads to fit your particular problems — cutter-heads and other accessories to replace those that are worn by hard wartime usage.

Help yourself to reduce "downtime" by consulting the WILSON TUBE CLEANERS CHECK-LIST. Your copy will be sent on request.

wilson
PIPE AND TUBE CLEANERS EXCLUSIVELY

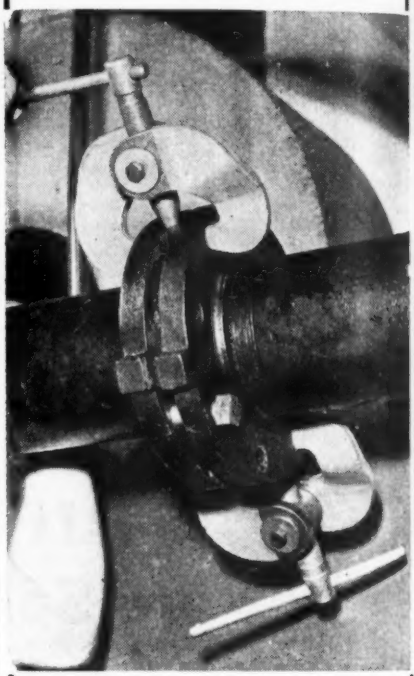
MODERN TUBE CLEANERS FOR THE PROBLEMS OF TODAY

TW-695

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK

FLANGE JACKS

. . . a New Tool that does a Hard Job the Easy Way



The job of opening flanges on pipe lines for gasket renewal, for which FLANGE-JACKS are specifically designed, can be done faster, easier, safer and more economically with this new tool, which has been tried and proved with outstanding success on countless tough, difficult jobs.

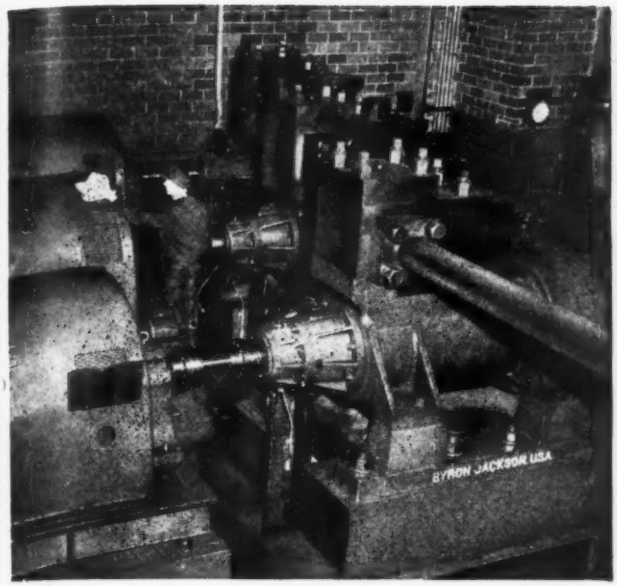
Flange-Jacks replace the old, slow, crude hammer-and-chisel way . . . open joints quickly even in cramped spaces . . . protect flange faces against damage . . . eliminate sparks from hammer and chisel blows as well as vibration in pipe lines. Flanges are separated gradually and evenly without undue strain; bolt holes are maintained in perfect alignment for positioning gasket.

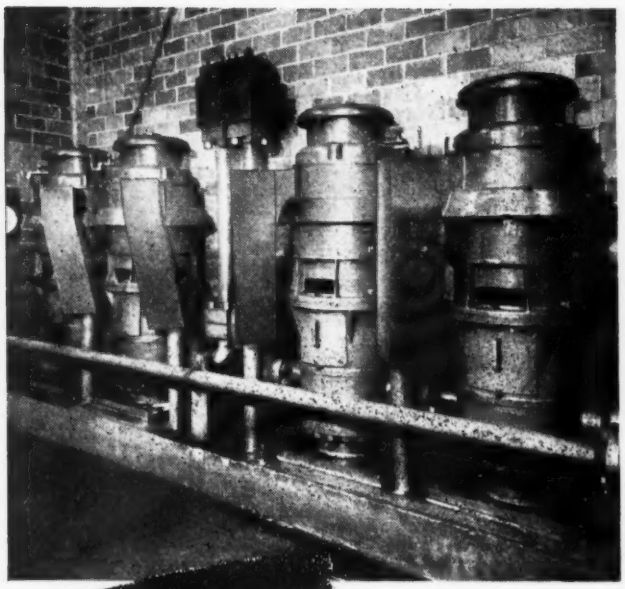
Strong, sturdy and simple in design, Flange Jacks are available in the following sizes and types:

Standard—2" to 20" Flanges including Extra Heavy up to 12".
Giant—20" and up.

Write Today for Complete Information to

T. G. PERSSON CO.
224 Glenwood Ave., Bloomfield, N. J.
Or Get in Touch with your Nearest Distributor.





These Byron Jackson Pumps

Mesta's 14,000 Ton Forging Press

TWENTY EIGHT MILLION POUNDS hydraulic force is supplied to this mammoth Mesta Forging Press through pumps engineered by Byron Jackson Co. For this specialized application of power, there were installed three double case eight stage pumps, each driven by a 2000 HP, 3600 RPM synchronous motor. Operating in series, they develop a pressure of 5400 psi at a capacity of 1500 GPM, and 6600 psi at shut-off.

For forging with less pressure anyone of the three pumps may be operated singly or in combination with either one or both of the others by a simple push-button control—at the operator's fingertips. Capacity remains constant while pressures are reduced one-third to two-thirds depending upon the number of units operated.

Unique in many respects, this pump installation represents a real advance in hydraulic forging.

Inherent to the centrifugal pumps are the following advantages—maximum limit pressure—no relief valve—nonpulsating flow—no rods or valves to wear—very small space requirement. *No stuffingboxes to pack* is the latest addition to the many other special advantages of these Double Case High Pressure Pumps.

Four 14 stage 150 HP, 3600 RPM Hydropress Pumps—two in series and two standbys—developing 2500 psi are used for manipulation of material under press and press dies.

This latter type pump is available as main power for presses of smaller capacity and pressures up to 5000 psi.

Through consultation we can develop the hydraulic application most fitted to your particular need.

CENTRIFUGAL AND TURBINE PUMPS

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

C. H. WHEELER OF PHILADELPHIA

STEAM CONDENSERS

•

AIR EJECTORS

•

MECHANICAL DRAFT COOLING TOWER

•

DECK MACHINERY

C. H. WHEELER MANUFACTURING Co.

19th St. & Lehigh Ave.

Philadelphia 32, Pa.

THE PACKING *for every Purpose*

ALLPAX

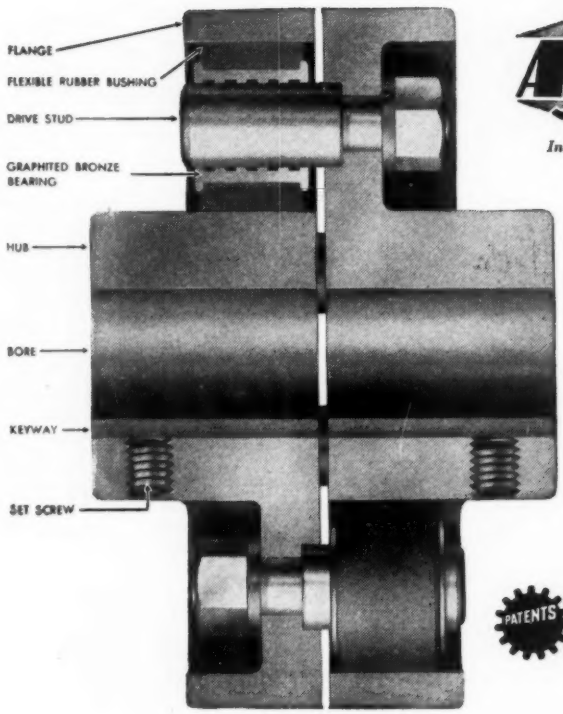
Stops Leaks and Prevents Scoring

This universal packing—consisting of long, tough asbestos fibres, thin flakes of anti-friction metal, minute graphite scales and a heat-proof lubricant—is recommended for general service against steam, water, air, ammonia, oils, gases, etc., where temperatures do not exceed 600 F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, food products, etc. Try it and you'll use it regularly.

Distributors everywhere

THE ALLPAX CO., INC.

MAMARONECK, N. Y.



AJAX

Incorporated 1920

PATENTS MAKE JOBS

The Inside Story of AJAX FLEXIBLE COUPLINGS

Ajax Flexible Couplings protect direct connected machines from unavoidable misalignment. They require no lubrication. They are quiet running — no backlash, no noise. They provide free end-float which permits electric machinery to find its magnetic center. They operate satisfactorily in abrasive-laden air.

They are built in a wide range of sizes and capacities with standard couplings *made of forged steel or cast semi-steel.*

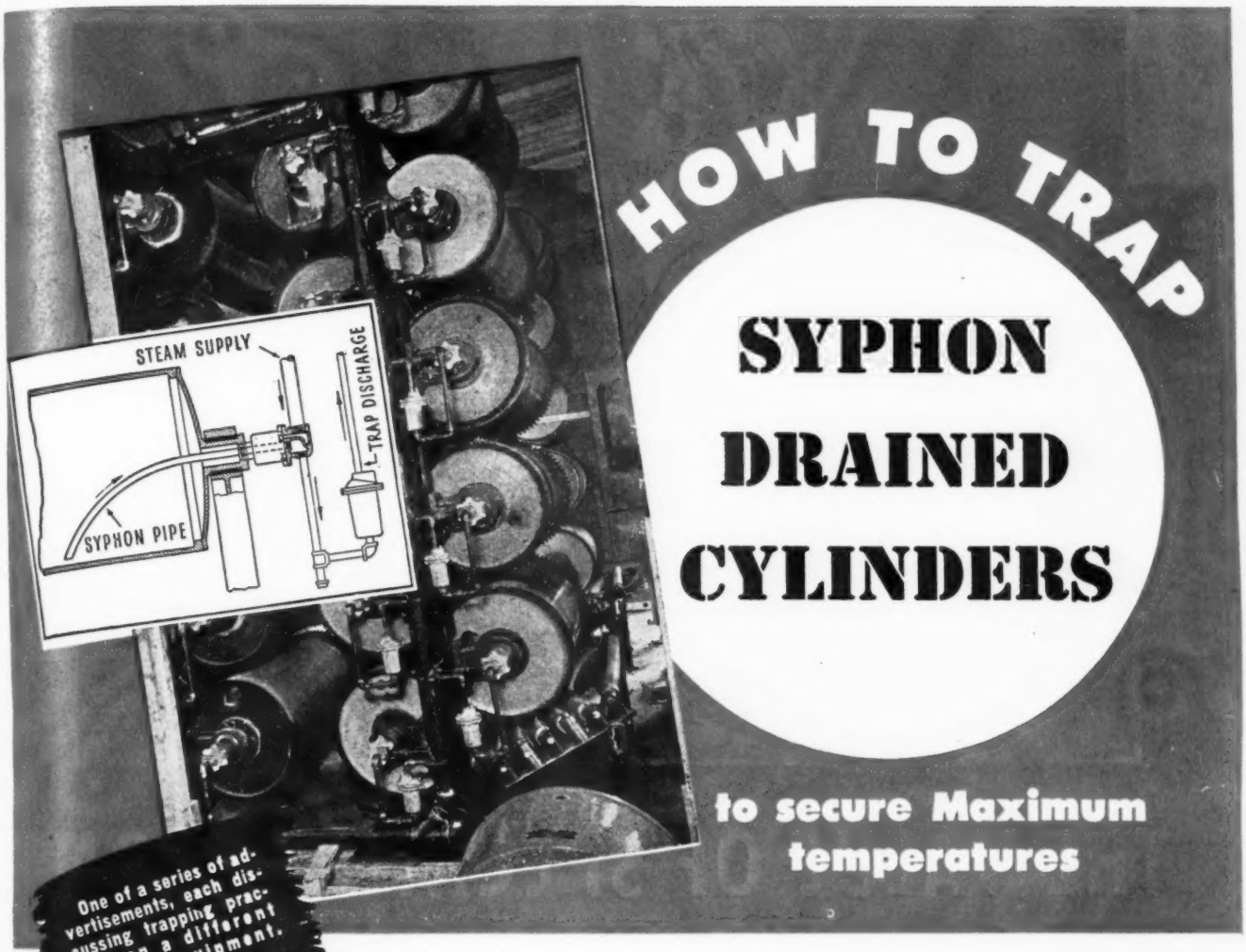
For special requirements flanges can be machined from aluminum, bronze or other metals, and can be plated with chrome, silver or cadmium for protection against adverse atmospheric conditions. Thousands of cadmium-plated Ajax Couplings are running on U. S. Navy equipment throughout the world.

Ajax Couplings can easily be made integral with brake drums, pulleys, fly wheels, etc.

Write for new catalog giving complete data.

AJAX FLEXIBLE COUPLING CO. INC.

WESTFIELD, N. Y.



HOW TO TRAP SYPHON DRAINED CYLINDERS

to secure Maximum temperatures

One of a series of advertisements, each discussing trapping practice on a different class of equipment.

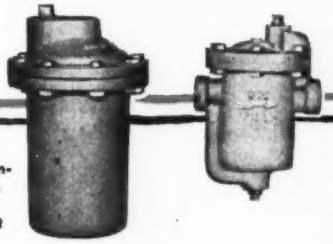
Paper Company Raises Temperatures of Corrugating Rolls 50%

Drainage of condensate from dry cans, slashers, sizers, corrugating rolls, double drum dryers and similar equipment requires a *practical experience* in installation practice plus traps capable of handling air as well as condensate. Armstrong offers both.

As a result, engineers have been surprised to find that despite previous trapping, Armstrong trap installations can effect results like these:

A Pittsburgh paper company raised corrugating roll temperatures 50% . . . a textile mill installed 200 Armstrong traps on dry cans after tests showed higher temperatures . . . Hyde Park Laundry, Chicago, increased ironer production 28%.

An Armstrong representative will be glad to call at your request. ARMSTRONG MACHINE WORKS, 812 Maple St., Three Rivers, Mich.



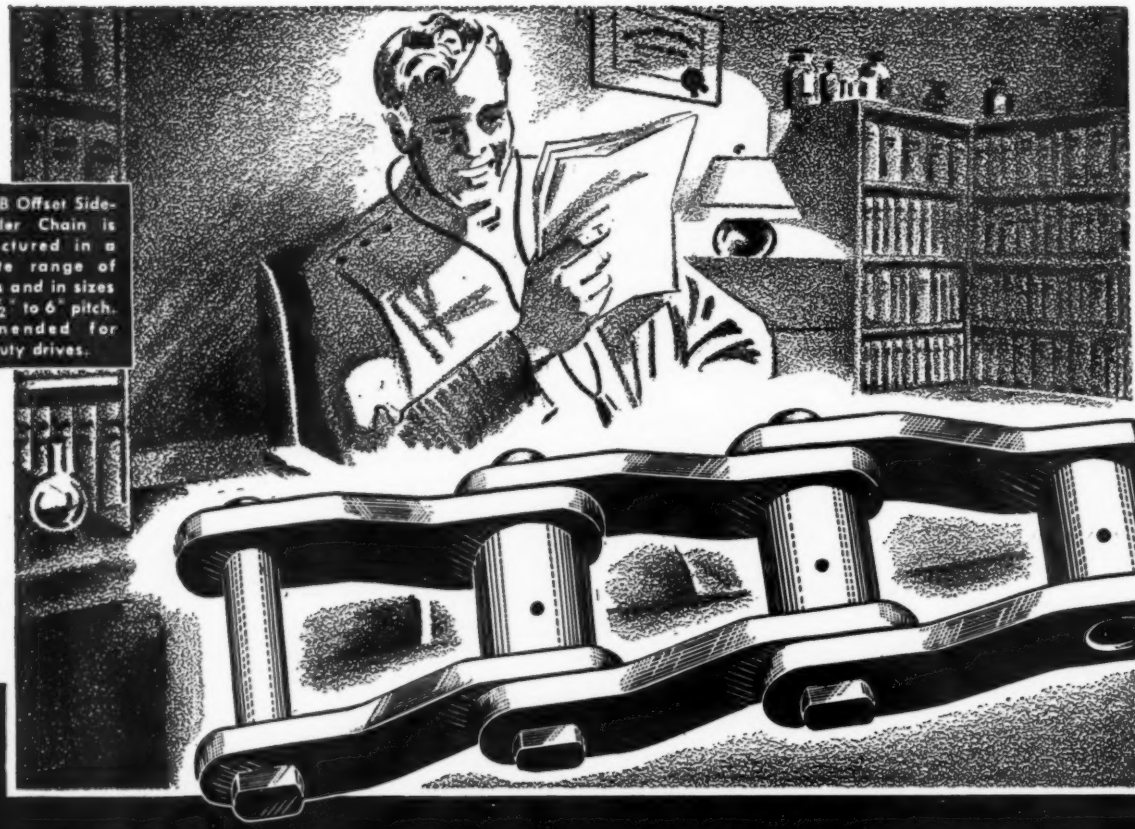
Trapping Tips*

- Be sure syphon pipe is curved downward, with the end of the pipe close to the shell.
- Use traps with ample air venting capacity.
- Be sure there is no dirt in syphon pipe and end is not burred.
- Use a trap on each cylinder.
- Be sure there are no leaks in syphon pipe.

*Complete, useful data contained in 36 page ARMSTRONG STEAM TRAP BOOK. Write for a copy — free on request.

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Over a Million in Use... For Power... Process... Heating



Union HB Offset Sidebar Roller Chain is manufactured in a complete range of strengths and in sizes from 1½" to 6" pitch. Recommended for heavy duty drives.

THE VALUE OF SPECIALIZATION

☆ Diagnosticians, after determining the cause of an illness, send the patient to another specialist who has had special training and experience concentrated in the particular kind of illness which is to be treated.

Similarly, many users of chain come to Union for advice on the proper chains for specific tasks of power transmission and mechanical handling of materials. Others ask Union to specify the correct Union Chains to incorporate as integral parts of their own machine products. This is because Union's complete effort is devoted exclusively to the design and manufacture of chains for these purposes. If you are not already aware of the advantages accruing from specialization, consult Union about your next chain problem.

The Union Chain and Manufacturing Company, Sandusky, Ohio, U. S. A.

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets

All manufacturer's standard, size ⅜ in. to 2½ in. pitch
Single and Multiple Strands
Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings

- Roller chain type
- Silent chain type

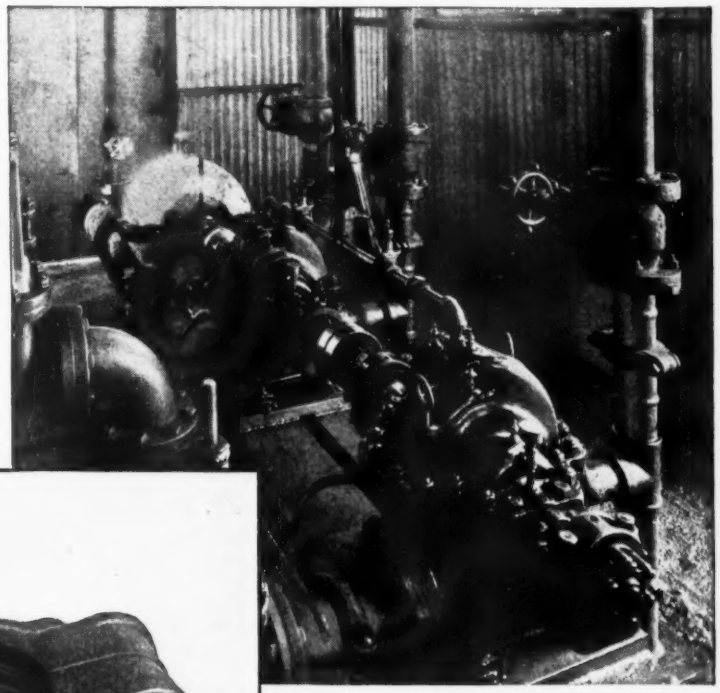
Catalog A-2 covers Drive and Conveying Chain. B-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

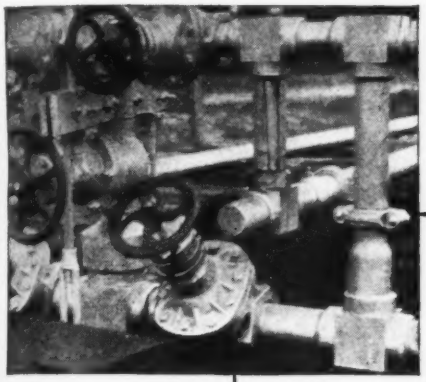
ARMY ★E NAVY

UNION CHAINS

Climax Flexible Lock Coupling ABSORBS VIBRATION

...protects valve and instrument settings. Prevents leaky connections in piping installations!





▪ *Climax Coupling on high pressure line. Compare leak-proof performance of coupling with leaky drop forge fitting at left.*

▪ *Piping and valves in this pump installation are effectively "insulated" from vibration by flexible, leak-proof Climax Couplings. Also, valve may be disassembled from line by removing bolts from* ONLY ONE *flange. Exclusive design features make Climax Couplings 100% satisfactory in service with steam, water, air, gasoline, kerosene, oil or gas up to 1000 lb. working pressure.*

ABSORBING VIBRATION from engines, pumps and compressors is but one of innumerable industrial applications in which Climax Flexible Lock Couplings have proved their superiority.

On high pressure lines—on all piping installations, above and under ground or under water, indoors or outdoors—wherever piping is subject to expansion or contraction from changing temperatures—wherever settling of tanks or vessels or other causes of line deflection may occur—wherever hammering may be set up by rapid opening or closing of valves—the flexibility of this coupling not only absorbs the vibrations and allows for deflection (up to 5 degrees at each coupled point), but also provides a positive permanent *pressure and vacuum tight seal* more enduring than the pipe itself.

With Climax Couplings, costly *threaded pipe and fittings* are eliminated. Connecting-up and disassembly are easy and quick. Money is saved on installations, labor—on material, maintenance and replacement expense.

FOR COMPLETE DETAILS write for Bulletin No. 130. McAlear Manufacturing Co., Automatic Control Division of Climax Industries, 33 N. Cincinnati St., Tulsa, Okla.

CLIMAX INDUSTRIES

McALEAR

PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE

controls

for STEAM, WATER, AIR, OIL-GAS

STOODY HARD-FACING ALLOYS

Lengthen the Service Life of Vital Equipment

AN APPLICATION of these wear-resistant alloys will result in a definitely longer life for equipment subject to wear and abrasion. Among the most popular Stoody alloys are:

Stoody No. 6 — for oxyacetylene use only, retains its hardness and wear resistance even at red heat. Cold hardness-Rockwell C 42-44, with high ductility . . . Withstands shock and impact without chipping, scaling or developing surface cracks.

Stoody No. 1 — Similar to No. 6 but cold hardness. Rockwell C 53-55 has greater hardness with less ductility and toughness.

Stoodite — a cast alloy steel rod which, when welded on to steel, provides an exceptionally hard, wear-resisting surface. Non-magnetic. Hardness Rockwell C 56 to 60.

Stoody Self-Hardening Rod — low-priced, abrasive-resisting, fabricated of steel strip and carefully selected alloys. Deposit is very tough and will test Rockwell C 50-54. Can be forged without loss of hardness.

Nationwide Airco offices offer a complete line of Stoody Hard-Facing Alloys to cover every variety of hard-facing application. For complete details, call or write your nearest Airco office.

Save Buying Time

Send for your FREE copy of this illustrated folder—"Welding Supplies Price List". It gives full details on Airco's comprehensive line of gas welding supplies. Address your nearest Airco office or write to Dept. P at the New York office.

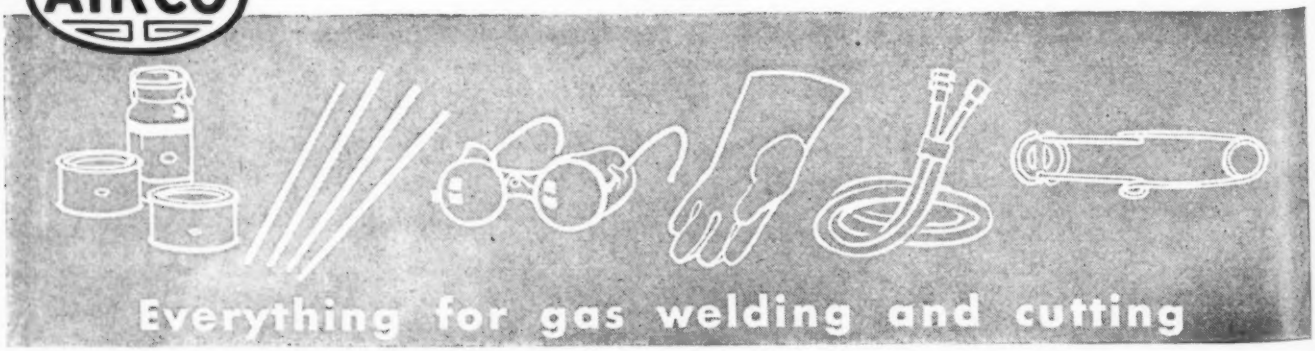
AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

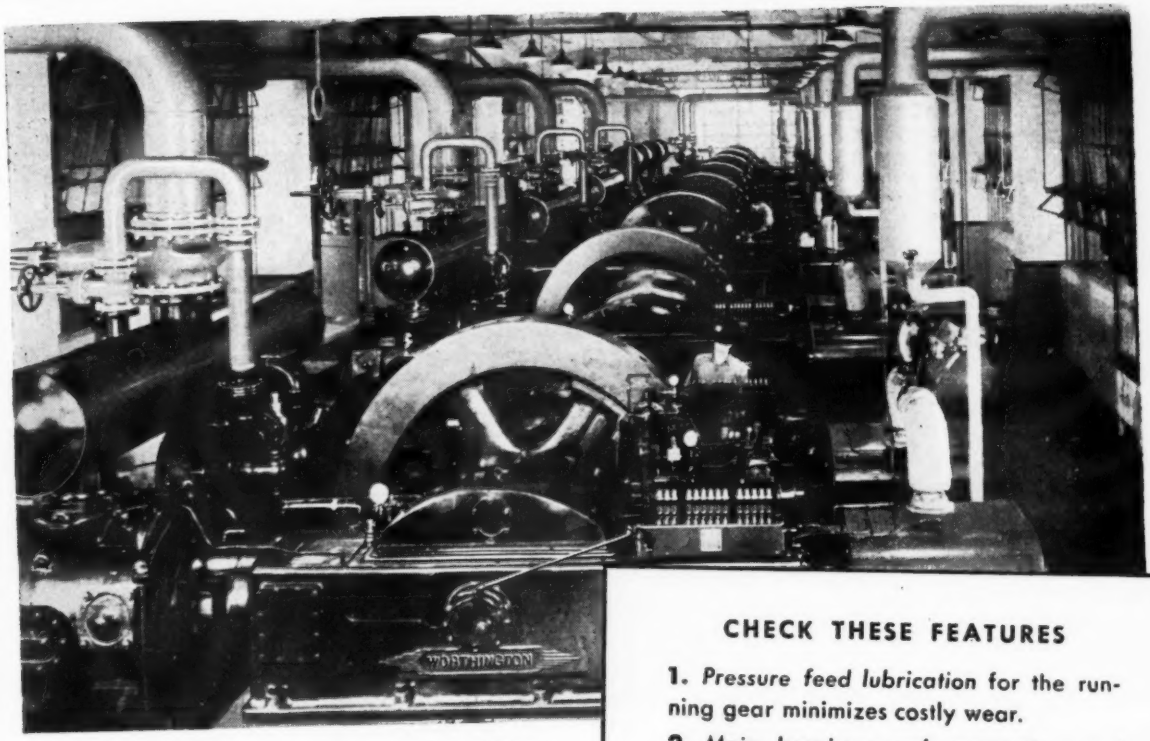
In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON 1, TEXAS

Offices in All Principal Cities

AIRCO



HOW TO GET LOW COST AIR FROM "NO" COST STEAM POWER



Battery of Worthington OXP Opposed Steam Driven Compressors in a large processing plant.

. . . *with minimum outage for adjustment*

In hundreds of plants where large quantities of exhaust steam are needed for heat exchangers and processing, Worthington Opposed Steam Driven Compressors with exclusive Feather* Valves are lowering air costs two ways. Because the steam drive on the compressor serves as a reducing valve on the process steam line, *power cost is negligible* . . . and because the composite effect of four Worthington features assures continuous heavy-duty service, *maintenance costs and outage time are kept at a minimum.*

*Reg. U. S. Pat. Off.

CHECK THESE FEATURES

1. *Pressure feed lubrication* for the running gear minimizes costly wear.

2. *Main bearings and connecting rod bearings are especially designed for pressure feed lubrication.* No troublesome, adjustable wedges...no weaving, no breathing of bearings.

3. *Operates on steam pressures as high as 450 p.s.i.* and corresponding high steam temperatures. Back pressures up to 200 pounds if desired.

These and other features that add up to low maintenance cost, high operating economy, freedom from operators' Sunday work prove that *there's more worth in Worthington.*

Write for literature . . . Publication Dept., Harrison, N. J. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

WORTHINGTON

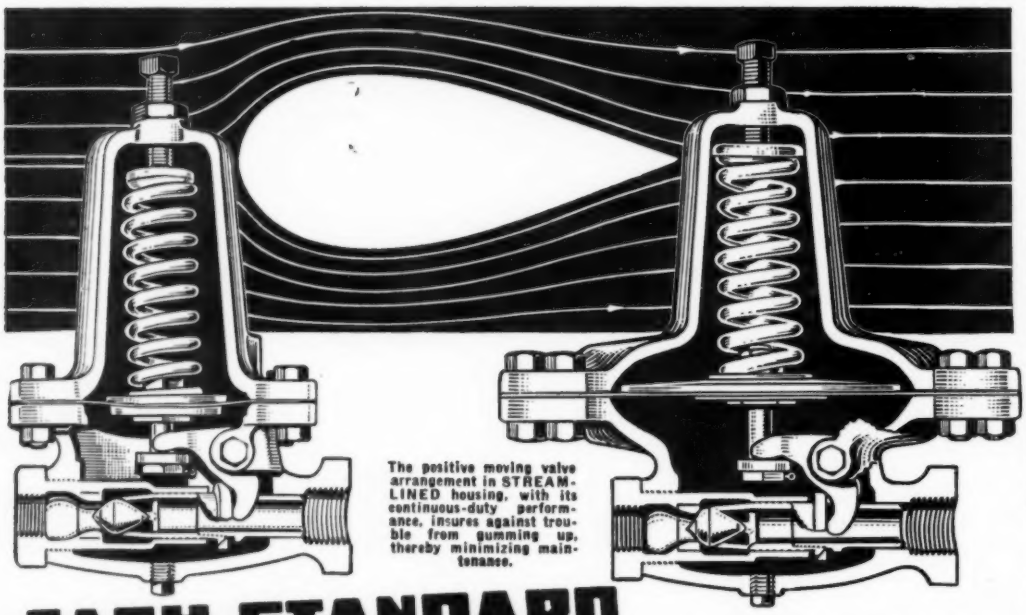
K5-42

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

Y-types | Vertical | Horizontal | Portable | Radial | Gas-Engine Compressors

You Get
MUCH MORE IN SERVICE

Because there's
MUCH MORE IN ABILITY



The positive moving valve arrangement in STREAM-LINED housing, with its continuous-duty performance, insures against trouble from gumming up, thereby minimizing maintenance.

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

There's much more ability in the CASH STANDARD "1000" because of the Streamlined design which has eliminated small ports and passages and complicated mechanism and in which there are but few close fitting parts.

Streamlined flow around the inner valve means no trouble from lack of capacity—even under peak load or sharp changes in demand the aspirating effect gets the valve wide open for maximum flow —you get accurate pressure control under tough operating conditions and there's never variation in the reduced pressure.

1. Maximum Capacity when needed most
2. Accurate Pressure Control under toughest working conditions
3. Trouble-free Service
4. Smooth Operation
5. Tight Closure
6. Accurate Regulation
7. Speedier Production Results
8. Elimination of Failures
9. Constant Delivery Pressure
10. Cost Saving Operation
11. No Spoilage
12. Practically zero in maintenance costs

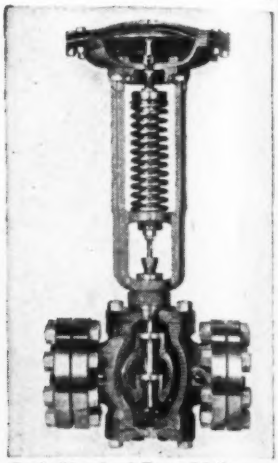
Read Bulletin 1000

See how this Streamlined design can fit your job — send for Bulletin 1000—read the detailed reasons for the greater performance ability —see why you can be sure of savings in operating and maintenance costs.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

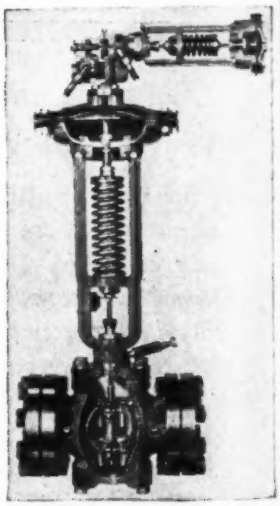
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 34 Pressure Reducing Valve. For practically all fluids. Has roller bearing, also roller guides that kill side strains and stop packing trouble —no lost motion.

Sizes: ½" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure vacuum to 150 lbs. Bodies: iron, bronze, steel. Trim: iron, bronze, stainless steel. Ends: screwed, flanged, ammonia type, welding type. Bulletin 968.

☆



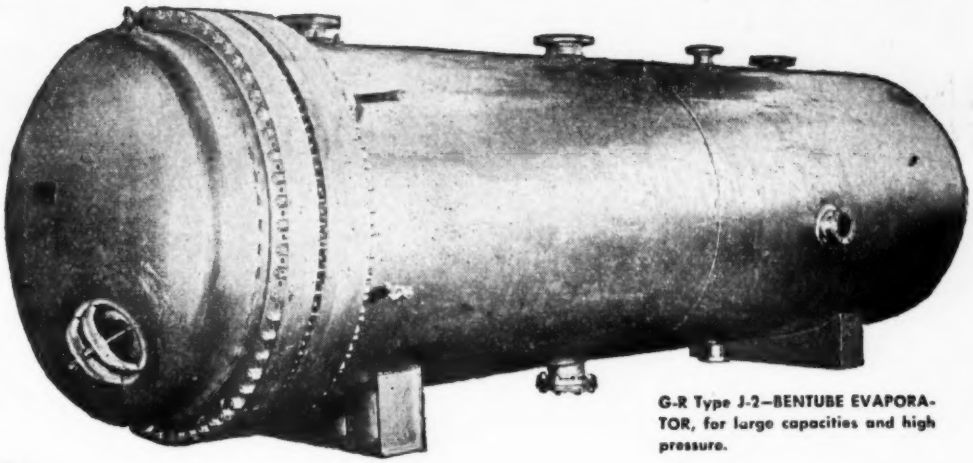
Cash Standard Type 30-AP Valve gives precise control of fluid pressures, through a pilot connected to the pressure under control. For steam, water, air, and most fluids.

Can be a pressure reducing valve or a back pressure valve depending on the way the control lines are connected. Pressures up to 600 lbs. Sizes ½" to 12" screwed; 1" to 12" flanged ends; wide variety of metals.

☆

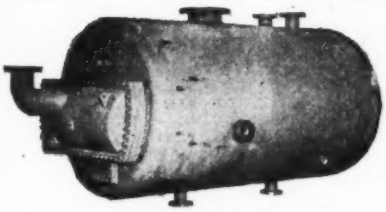
PRESSURE.....HIGH OR LOW

CAPACITY.....LARGE OR SMALL

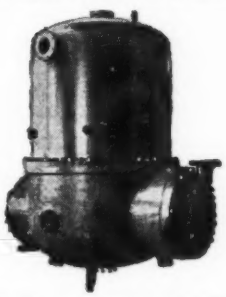


G-R Type J-2—BENTUBE EVAPORATOR, for large capacities and high pressure.

There's a G-R BENTUBE EVAPORATOR for every requirement of boiler feed make-up



G-R Type N—BENTUBE EVAPORATOR, for moderate capacities and low pressure.



G-R Type H — Vertical BENTUBE EVAPORATOR, for small capacities.

No matter what size or type of boiler-feed make-up evaporator may be best suited for your particular plant conditions, an exactly suitable G-R BENTUBE EVAPORATOR is available for your precise requirements.

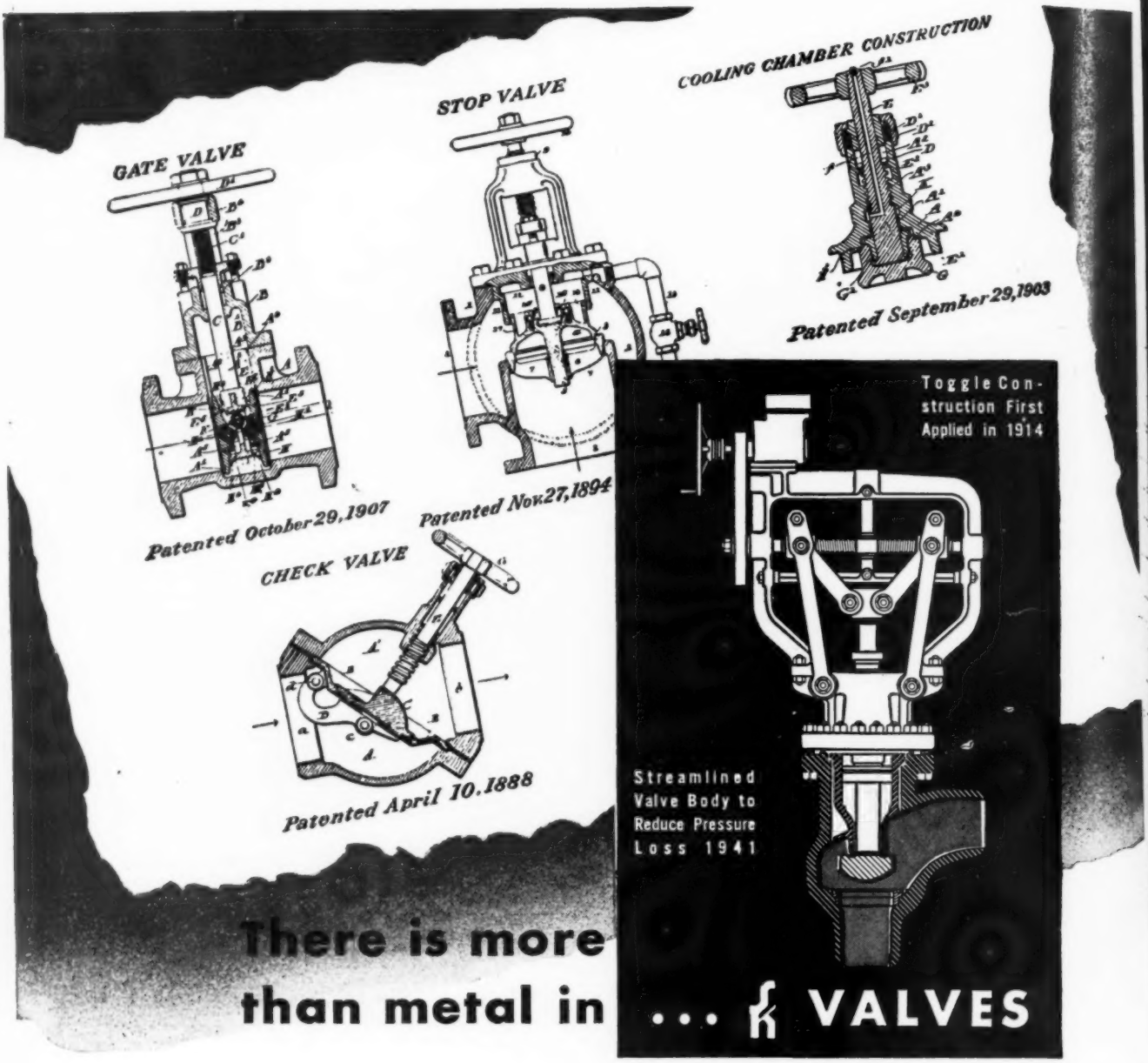
The design of these evaporators . . . based on 75 years of experience in building heat transfer apparatus . . . has several distinctive advantages assuring vapor that is both pure and dry, and with large overload capacity. In addition, these units have exclusive features that *maintain* rated capacity without the necessity of hand-scaling, and provide greatest ease of inspection and minimum attendance.

Bulletin 362 describes G-R BENTUBE EVAPORATORS in detail, explains in what plant conditions evaporators should be used, and analyzes their association with the plant heat balance. Your copy of this informative bulletin will be sent on request.

THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE, NEW YORK 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus


GATE VALVE
Patented October 29, 1907
STOP VALVE
Patented Nov. 27, 1894
COOLING CHAMBER CONSTRUCTION
Patented September 29, 1903
CHECK VALVE
Patented April 10, 1888
Toggle Construction First Applied in 1914
Streamlined Valve Body to Reduce Pressure Loss 1941
There is more than metal in ... VALVES

In addition to good materials, there are sixty years of research, design and construction experience in today's SK Valves. Into each one goes ideas which result from long familiarity with the problems involved, from a long established procedure of improving on past performance, and of doing what has never been done before.

Schutte and Koerting valve patents are documented proof of this pioneering leadership. Dating as far back as 1885, these patents cover many ideas which are now standard in the industry. The swing-disc check valve, patented in 1888, the cooling chamber which permits packing of stuffing boxes while the valve is under pressure, patented in 1903, and the cushioning chamber on non-return valves, patented in 1894, are but several of a distinguished list of SK engineering achievements.

Just as Schutte and Koerting was a jump ahead in the days when steam power was beginning to grow, so today their continuing leadership is improving past practices and meeting new demands. Many of these new designs will also become standard when patents expire.

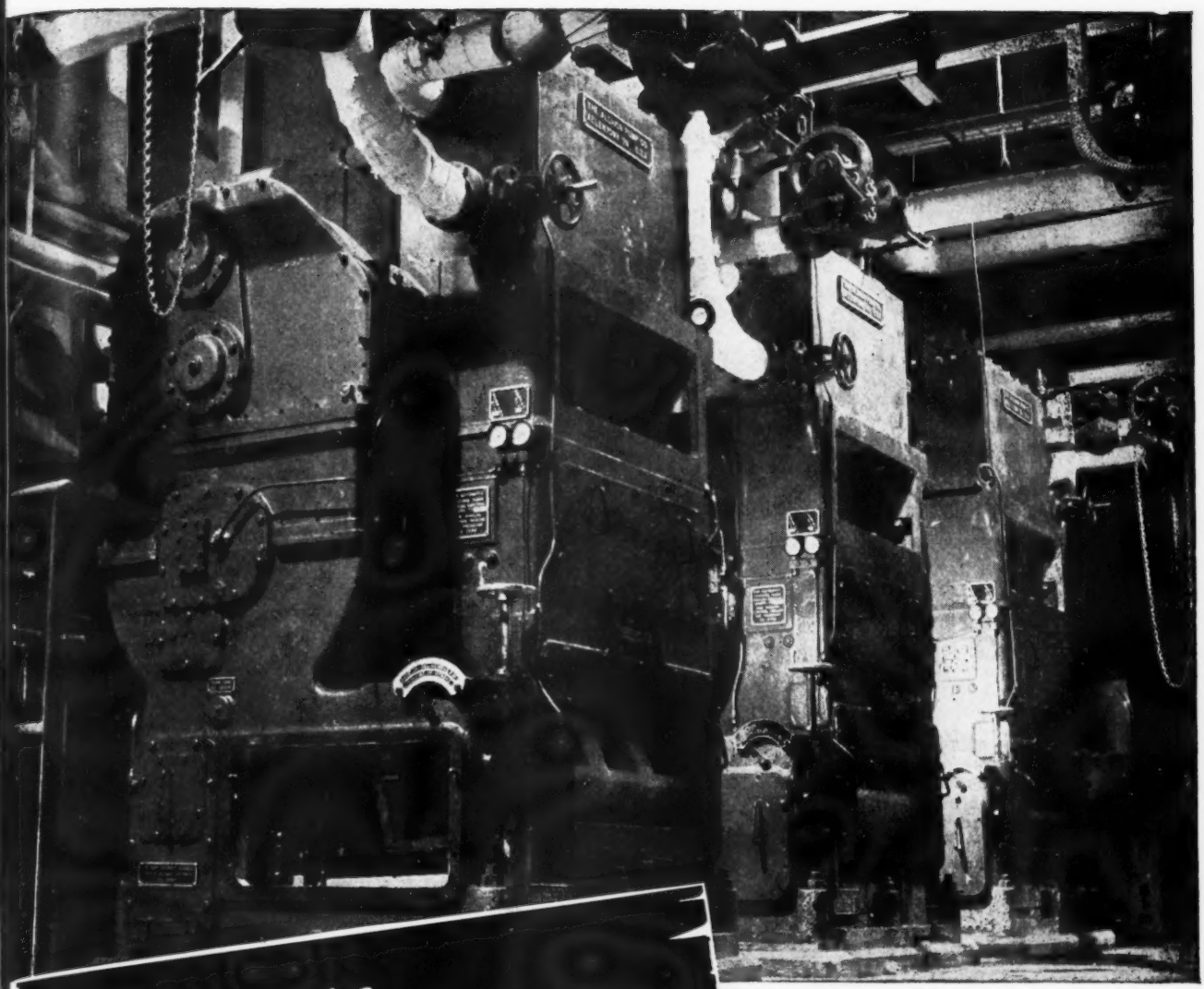
Knowledge, acquired only by long experience, is one of the intangibles which makes SK Valves dependable, trouble-free and up-to-the-minute. Benefit by Schutte and Koerting's proved ingenuity. Specify SK Steam Valves.

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS
CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT
ROTAMETERS AND FLOW INDICATORS • RADIAFIN TUBES
VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS

SCHUTTE & KOERTING CO.

Manufacturing Engineers

1150 Thompson St., Philadelphia 22, Pa.



Increase POWER PLANT EFFICIENCY with

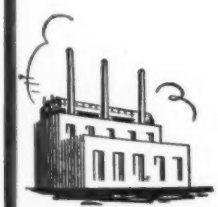
...ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMPS

Aldrich-Groff pumps on unit feed systems eliminate pressure and power losses common to throttling-type feed regulating valves and offer advantages of feed system simplicity, efficiency and mechanical reliability for small and medium installations at medium and high steam pressures.

Equally important overall power savings are effected by Aldrich-Groff pumps on de-superheater feed service in connection with high pressure topping units for power stations of any size.

The three Aldrich-Groff 3¼" x 0 to 6" variable stroke vertical triplex pumps shown above are in service in a mid-western central station employing the unit system for main boiler feed. Two are driven by constant speed motors and the third by a constant speed steam turbine. Power consumption is almost directly proportional to pump delivery.

The 6" stroke—3¼" plunger pump is a 100 HP unit and when operating at maximum speed can deliver 70,000 pounds of feed water per hour against 1025 pounds boiler pressure.



WRITE TODAY...

for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

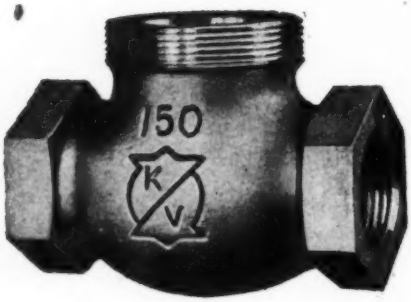
THE ALDRICH PUMP CO. ALLENTOWN • PENNA.

REPRESENTATIVES: Birmingham • Bolivar, N. Y. • Boston • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Los Angeles • New York • Pittsburgh • Portland, Ore. • St. Louis • San Francisco • Seattle • Tulsa

"Trifles make perfection but perfection is no trifle"

Sure to fit exactly because of KENNEDY Interchangeability

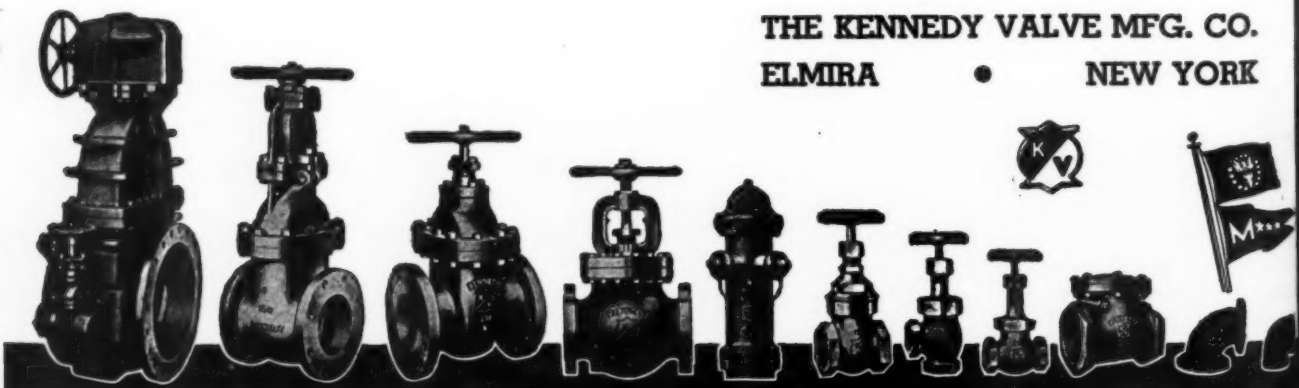
One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.



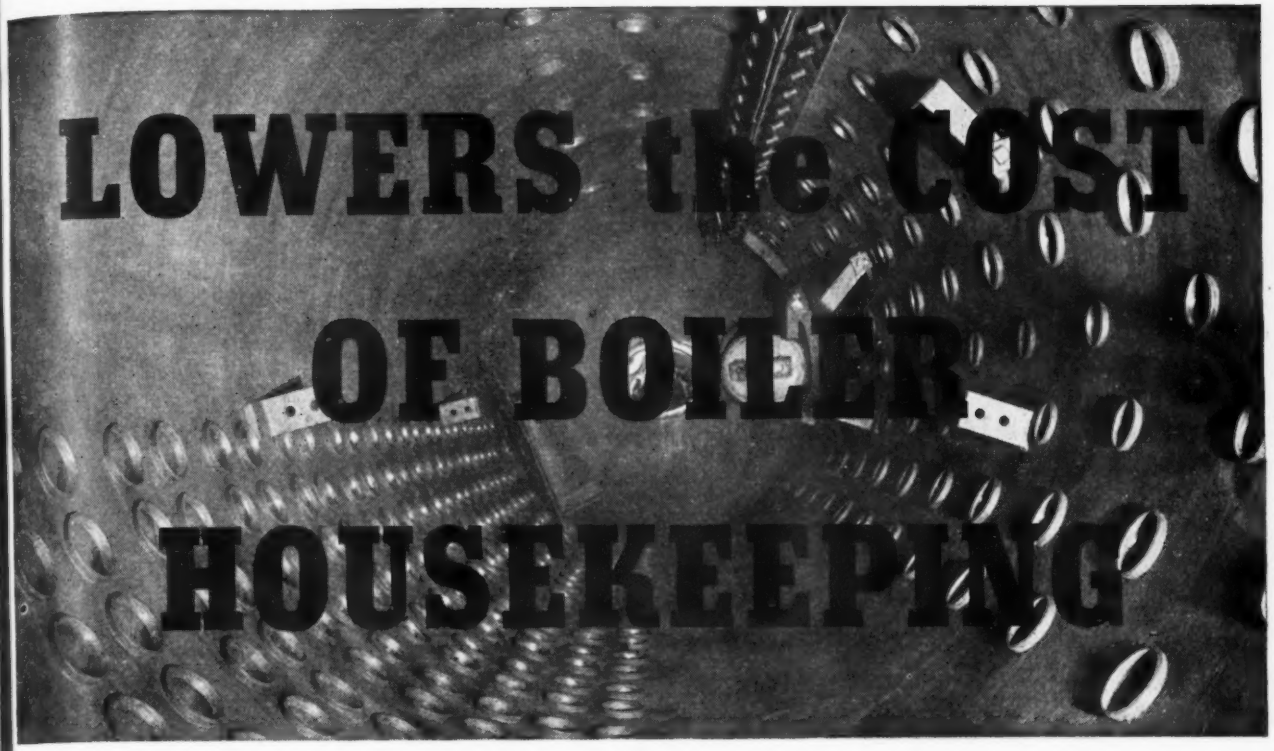
With a given size and type of valve, it doesn't matter what Kennedy globe or angle body you pick . . . the stem and bonnet assembly will fit exactly, and the valve will operate perfectly.

This feature indicates our precision machine work throughout every Kennedy valve type. That's one of many reasons why so many experienced plant engineers insist on Kennedy Bronze and Iron Body Gate, Globe, Angle and Check Valves, and why it will pay you, too, to use these high-quality valves for all your standard requirements.

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK



KENNEDY valves . . . pipe fittings . . . fire hydrants



APEXIOR NUMBER 1 brings economy to boiler maintenance by:

1. preserving metal surfaces under the coating
2. preventing direct bonding of dirt or scale
3. reducing the labor of boiler maintenance
4. sealing off water-contact at all joints

In cooperation with proper feedwater treatment, APEXIOR NUMBER 1 successfully combats corrosion at its source. It is recommended by all boiler insurance companies in the United States and Canada. If desired, all boiler manufacturers will quote on the preparation of drums and tubes and the application of APEXIOR, under Dampney Company supervision.

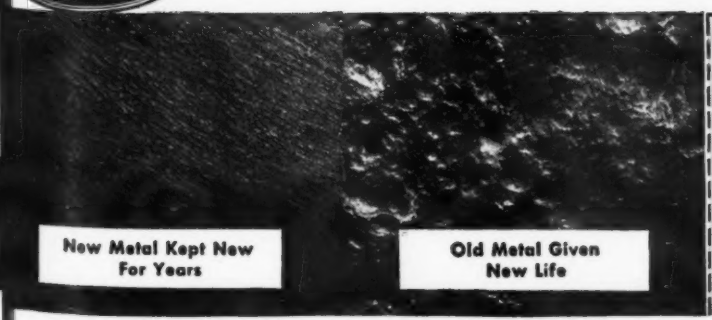
FOR "COLD-WET" METAL

APEXIOR NUMBER 3 is the counterpart of APEXIOR NUMBER 1 for preserving and simplifying the maintenance of metal subject to contact with cold water, either salt or fresh. Non-toxic, it can be used for potable water tanks, feedwater tanks, condensers, cooling towers, etc., where temperatures do not exceed 125°F.

Repeat Users Like These Have Used APEXIOR for Years

Vanderbilt University
Tide Water Associated Oil Co.
Southwestern Public Service Co.
Morton Salt Company
Minnesota & Ontario Paper Co.
Connecticut Light & Power Co.
Kaiser Company, Inc.
Detroit Edison Company
Chemical Warfare Service
Bethlehem Steel Co.
Amalgamated Sugar Co.
Utah Canning Company

APEXIOR — *Keeps new metal new . . . Gives old metal new life* — DAMPNEY



THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Boston 36, Mass.

Please send free Bulletin 1290.

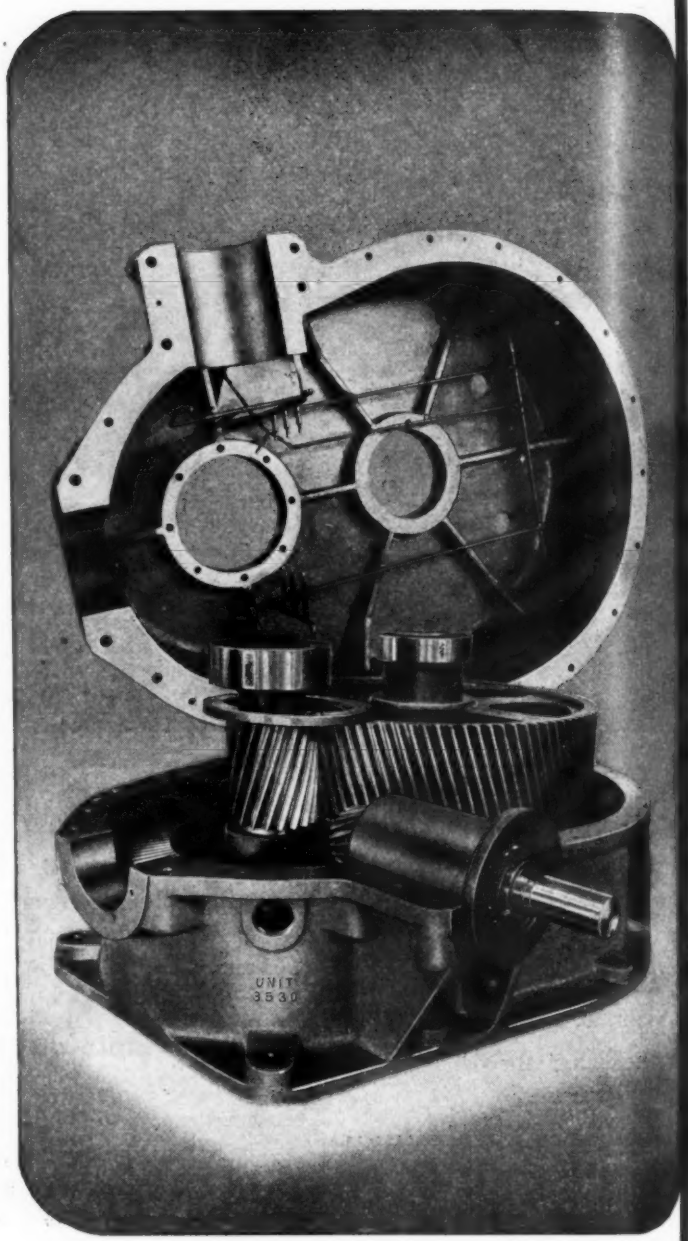
Name.....

Company.....

Address.....

.....

● *Built by* THE PHILADELPHIA GEAR WORKS, INC., *this Unit 3530 VBH Reduction Gear is 92" long, 57" high, and weighs 16,800 lbs.*



Bearings

FOR REDUCTION GEARS

Putting the right bearing in the right place pays big dividends on this VBH Reduction Gear Unit, which has a capacity of 188 h.p. at 424 r.p.m. input, 21-1 ratio. For seven SKF Bearings assure proper gear alignment and permit a smooth-running unit. Having built-in alignment, SKF Spherical Roller Bearings maintain high load carrying capacity for useful work at all times. They never need adjustments. Wherever there's an SKF, the right bearing is in the right place. 5896

SKF INDUSTRIES, INC., PHILA. 34, PA.

SKF

BALL AND ROLLER BEARINGS

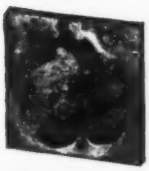
"This test proves I have a high Rust I.Q.*!"

**Inhibitive Quality*

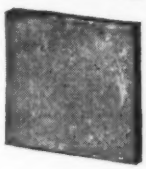
EAGLE SUPER "66" INSULATING CEMENT

Here's proof from the laboratory!

Shown below are unretouched photos of two steel blocks used to test the rust-inhibitive properties of Eagle Super "66".



Here is how one block looked after being imbedded in a regular insulating cement for the test period. Note the heavy coating of rust. Such corrosion also occurs on iron and steel equipment, whether heated or cold.



This is how the other block looked after being imbedded in Eagle Super "66" for the same test period. Note how free of rust it is. The rust-inhibiting properties of Eagle Super "66" will protect *your* heated equipment just as effectively!

"Springy Ball" structure gives high insulating efficiency

Eagle Super "66" does a tremendously efficient job of insulating because it's filled with "springy ball" pellets of Eagle Mineral Wool. Each pellet contains thousands of tiny dead air cells which impart extremely low thermal conductivity.

This unique plastic insulation withstands a full range of temperatures up to 1800° F., and, if not used at temperatures above 1200° F., can be *removed, remixed, and reused!* Eagle Super "66" applies easily and quickly to almost any shape or size surface. Exceptionally high dry coverage gives lower cost per square foot than most insulating cements or blocks.

Data sheets with complete technical information are available on request.

FREE Manual! Gives case examples of how industrial insulation effects large fuel savings. Includes Heat Loss Estimate Sheet for your use. Write for your copy.

Now Buy Victory Bonds

Other Eagle Industrial Insulations Include:

Eagle Insulseal. A protective coating for insulation. Trowels on—dries to a hard finish. Withstands up to 450° F.

Eagle Swetchek (black). A prepared, asphaltic base, rust-inhibitive anti-condensation compound.

Eagle Drycote (white). A dry, ready-to-mix, rust-inhibitive anti-condensation compound.

Eagle "43" Finishing Cement. A hard white finish coating for all types of indoor insulation within a range from 70° F. to 800° F.

EAGLE-PICHER INSULATIONS
High and Low Temperature

EAGLE EP PICHER

Made by THE EAGLE-PICHER LEAD COMPANY • CINCINNATI (1), OHIO

Eagle Super "66" Insulating Cement • Eagle L-T and M-24 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetcheck • Eagle Drycote

Production Problems YOU CAN Forget WITH Veelos

A V-BELT that requires constant, time-wasting maintenance is a production handicap. You need NOT put up with it . . . when you can replace with Veelos—the adjustable V-belt. Then—you can *forget* these power transmission worries:

1. Lengthy Machine Shutdowns to Permit Belt Replacement: With Veelos in rolls, V-belts can be replaced in a few minutes . . . maintaining machine production . . . reducing machine downtime.

2. Belt Slippage: Veelos link construction provides quick, easy tension adjustment to end slippage . . . keeps machinery running at full speed and productivity.

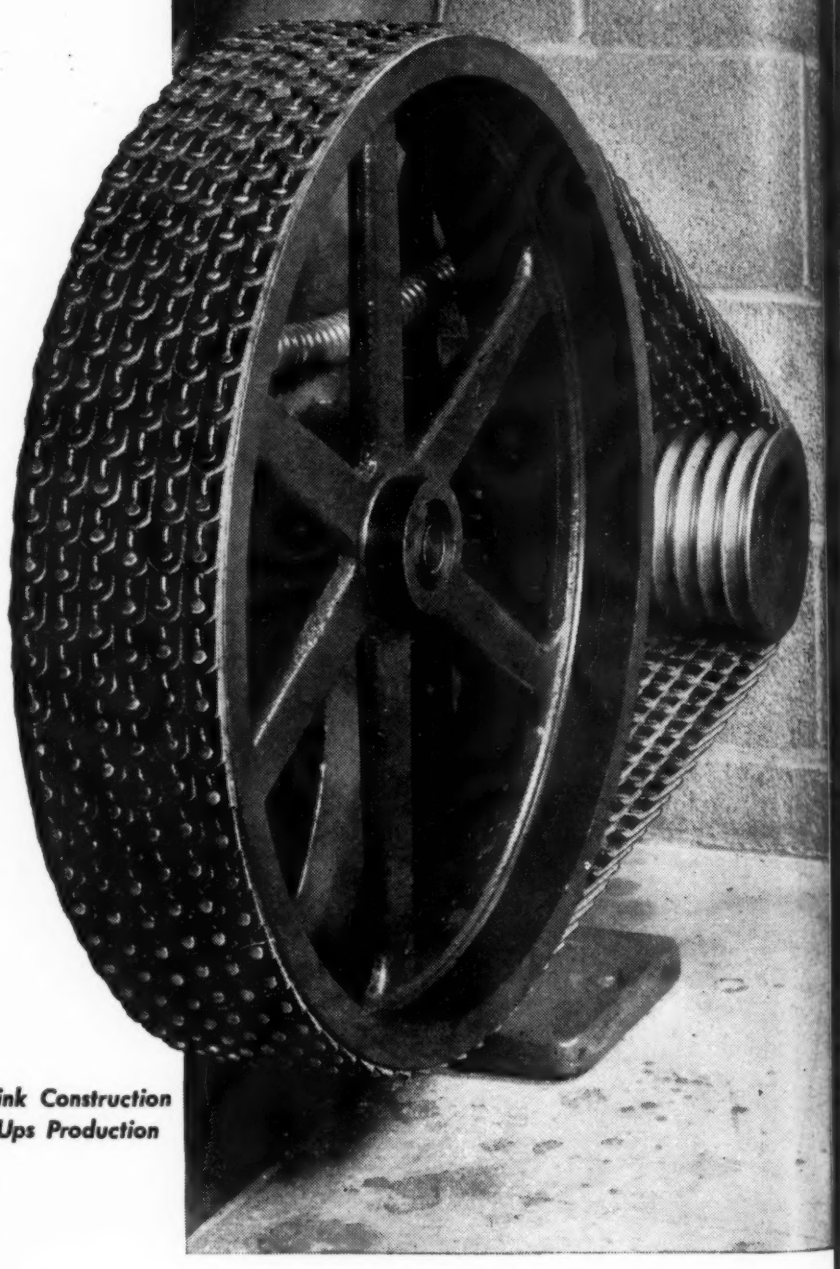
3. Uneven Delivery of Power on Multiple Drives: Easy adjustment of Veelos assures that each strand of a multiple belt will carry its exact share of the load. All strands constantly work together, *delivering full power.*

4. Bulky, Expensive Belt Inventories: Veelos lowers investment in V-belt stock and space . . . rolls of common sizes provide belts of any desired length . . . simplify stock records.

There's a book waiting for you that's a guide to easier belt maintenance and installation. It's the *free 8-page illustrated manual* giving Veelos applications, construction detail, installation directions and engineering data. *Write for your copy today.*

Simple as Buttoning a Shirt

Get the "hang" of it, and you'll couple and uncouple Veelos as easily as you button your shirt. This unique, link construction is the big reason why production goes up when Veelos goes on.



Link Construction Ups Production

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PA.

SCALEY

WILL GET YOU IF YOU DON'T WATCH OUT!

Years of scientific research... unceasing experiment... and deep-searching analysis have established **ALKEN CERTIFIED SCALOFF** as one of America's foremost boiler treatments.

Treating both the water and the metal, **ALKEN CERTIFIED SCALOFF** works with unmatched efficiency, preventing and eliminating scale, inhibiting further corrosion and pitting, minimizing priming, foaming and carry-over.

Before any formula is recommended water samples are taken from various parts of the system and analyzed. In addition a personalized written survey of your boiler operation is given to our Engineering Department. After careful study, the formula best suited for your needs is sent to you.

Illustrated booklet sent free upon request.

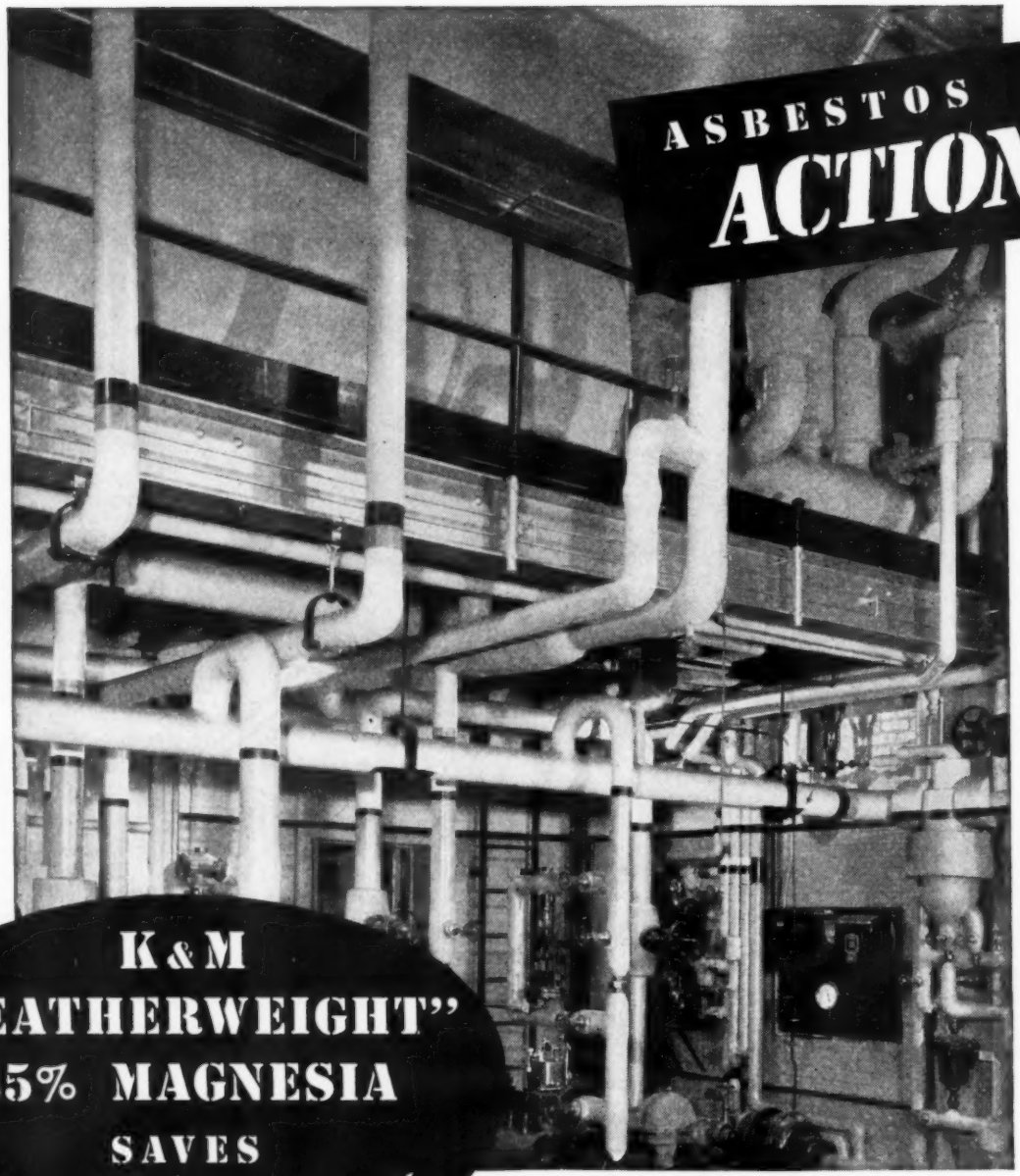
For maximum boiler efficiency, use

ALKEN CERTIFIED SCALOFF WATER TREATMENT
Reg. U. S. Pat. Off.

ALKEN-MURRAY
CORPORATION

1841 BROADWAY, Dept. P • NEW YORK 23, N. Y.

ALKEN CERTIFIED PRODUCTS: WATER TREATMENTS · SOOT REMOVERS · SLUDGE REMOVERS



K&M "FEATHERWEIGHT" 85% MAGNESIA SAVES HEAT · FUEL · MONEY

TESTED BY TIME . . . PROVED BY PERFORMANCE

The extensive network of steam and hot water lines in this large mid-western power plant are insulated with K&M "Featherweight" 85% Magnesia. This choice was not the result of guesswork, but was based on sound engineering calculations made after a thorough analysis of previous pipe line heat losses.

K&M "Featherweight" 85% Magnesia Pipe Insulation offers lasting effectiveness, durability, dependability and low maintenance costs. It saves heat . . . fuel . . . money. For temperatures up to 600° F., no other material can offer such enduring economy.

K&M "Featherweight" 85% Magnesia Pipe Insulation combines the high insulating qualities of basic Carbonate of Magnesia with strong Asbestos Fibres. Although extremely light in weight, it delivers maximum efficiency. For 65 years, plant operating men have known "Featherweight" as a symbol of quality.

ARMY E NAVY
K&M
best in asbestos

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

STRENGTH

FOR SAFETY AND LONG-TIME SERVICE

Specify

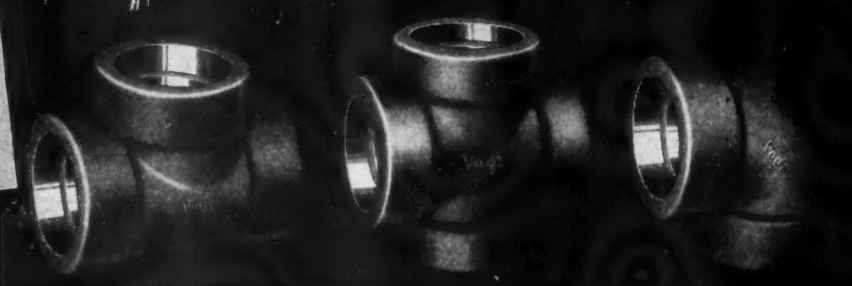
Vogt

DROP FORGED STEEL FITTINGS

SCREW END TYPE

For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SOCKET WELD TYPE



For schedules 40, 80 and 160 pipe — Sizes 1/8" to 6"

Round-the-clock operation of oil refineries, chemical plants, steam plants, etc., essential to the continuous flow of war products to the United Nations, is all in the day's work for these fittings. Today, as in peacetime, Vogt drop forged steel fittings make a major contribution to the efficient functioning of pipe lines in plants vital to the war effort.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy.

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-8 will aid you in their selection and proper application.

HENRY VOGT MACHINE CO., Inc., LOUISVILLE 10, KY.

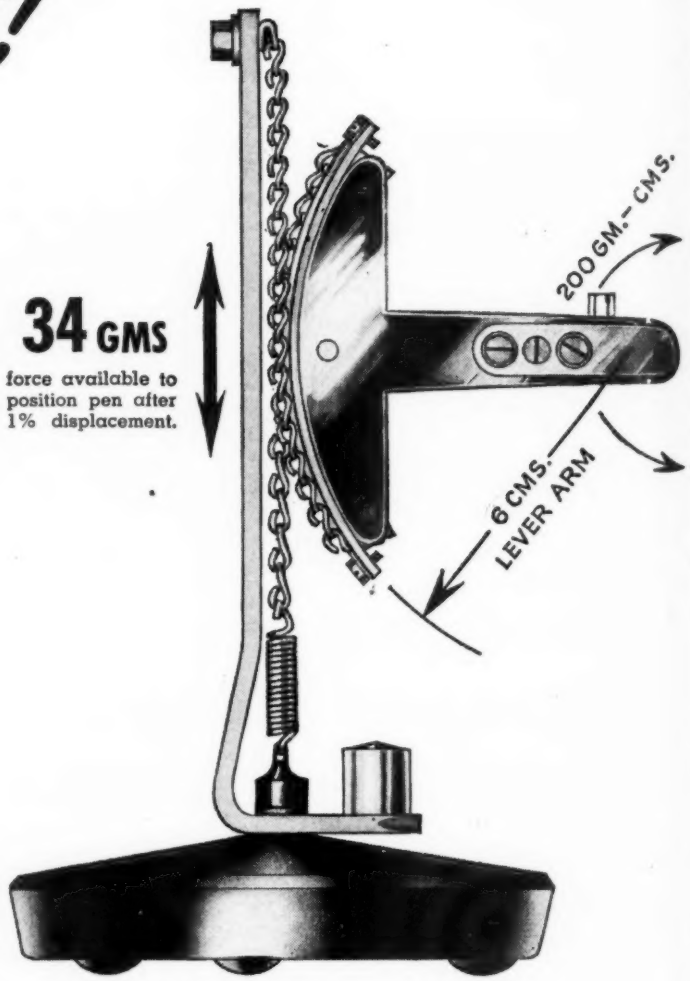
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

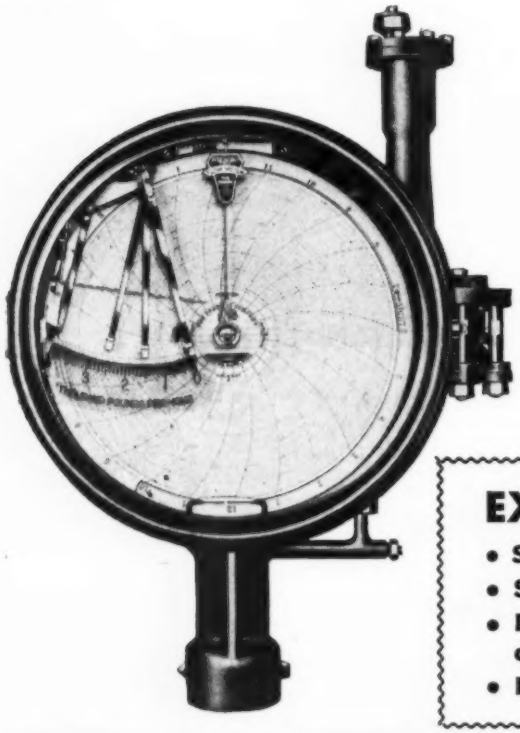
Here's FLOAT POWER *...and no foolin'!*

Driving torque of over 200 gm.-cms. *forces* accuracy in Foxboro Meter Records, despite dirt or scale.

It's typical of Foxboro's *better-engineering-to-the-last-detail* that Foxboro Flow Meters have extra-large floats with extra-long travel. This exclusive feature gives nearly double the power to prevent frictional inaccuracies. For example, in Type 4 and Type 8 Foxboro Meters, it provides pen torque of more than 200 gram-centimeters with a float displacement of only 1% of scale range.

Foxboro Flow Meters cost no more than other meters of the same type. Yet their rugged, better-engineered design means important extra values . . . easier installation . . . simpler, less-frequent servicing . . . positive saving of mercury . . . unvarying accuracy throughout years of use.





New Bulletin 200-7 gives detailed information on the extra-value features of Foxboro Meters for all pressures up to 5,000 lbs. Write for your copy. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A.** Branches in principal cities.

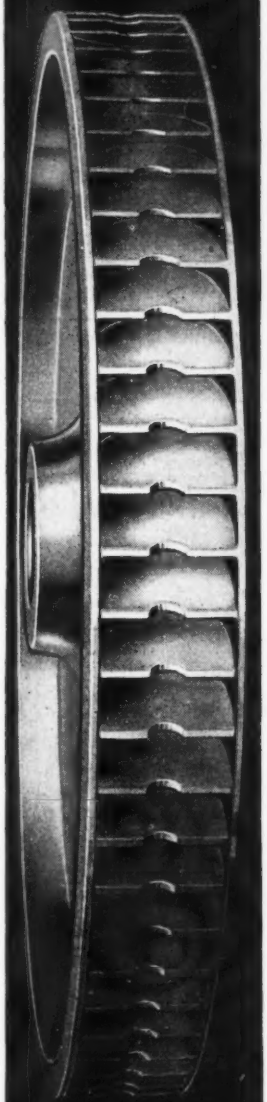
EXCLUSIVE FOXBORO REFINEMENTS

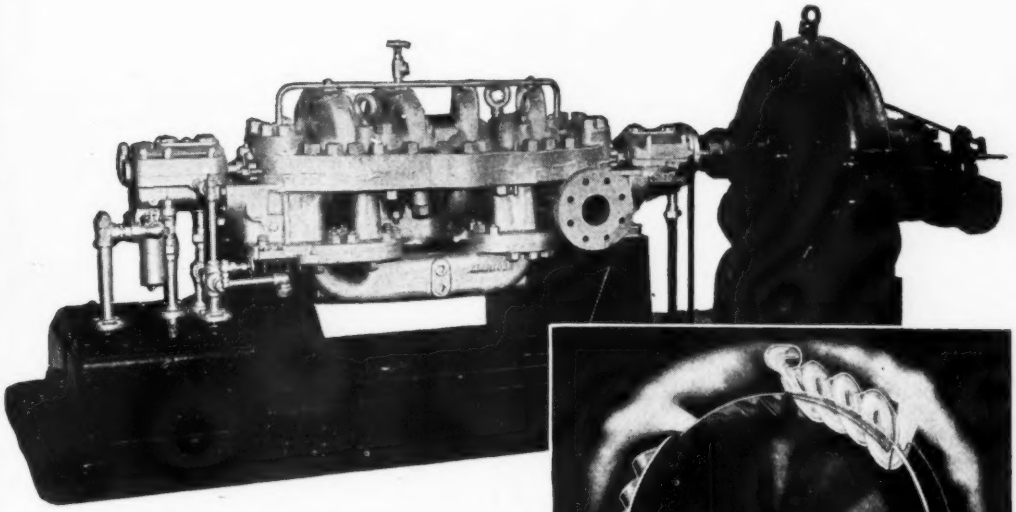
- **Segmental Lever Transmission gives straight-line calibration.**
- **Sure-Seal Check Valves positively prevent mercury losses.**
- **Pressur-Tite Bearing eliminates friction of stuffing boxes or multiplication for flexure or torque tubes.**
- **Extra-large Float with long travel gives extra power.**

FOXBORO REG. U. S. PAT. OFF.

MONEY-SAVING FLOW METERS

TERRY





A DURABLE . . . EASY TO OPERATE AUXILIARY DRIVE STEAM TURBINE

Pictured above is a 125 HP Terry Solid-Wheel Turbine direct connected to a centrifugal pump. The turbine wheel of this unit is shown at the left and the action of the steam in the wheel is shown at the right.

This rotor construction offers many advantages:

— The blades and the wheel are in one piece so that there are no parts to become loose or work out.

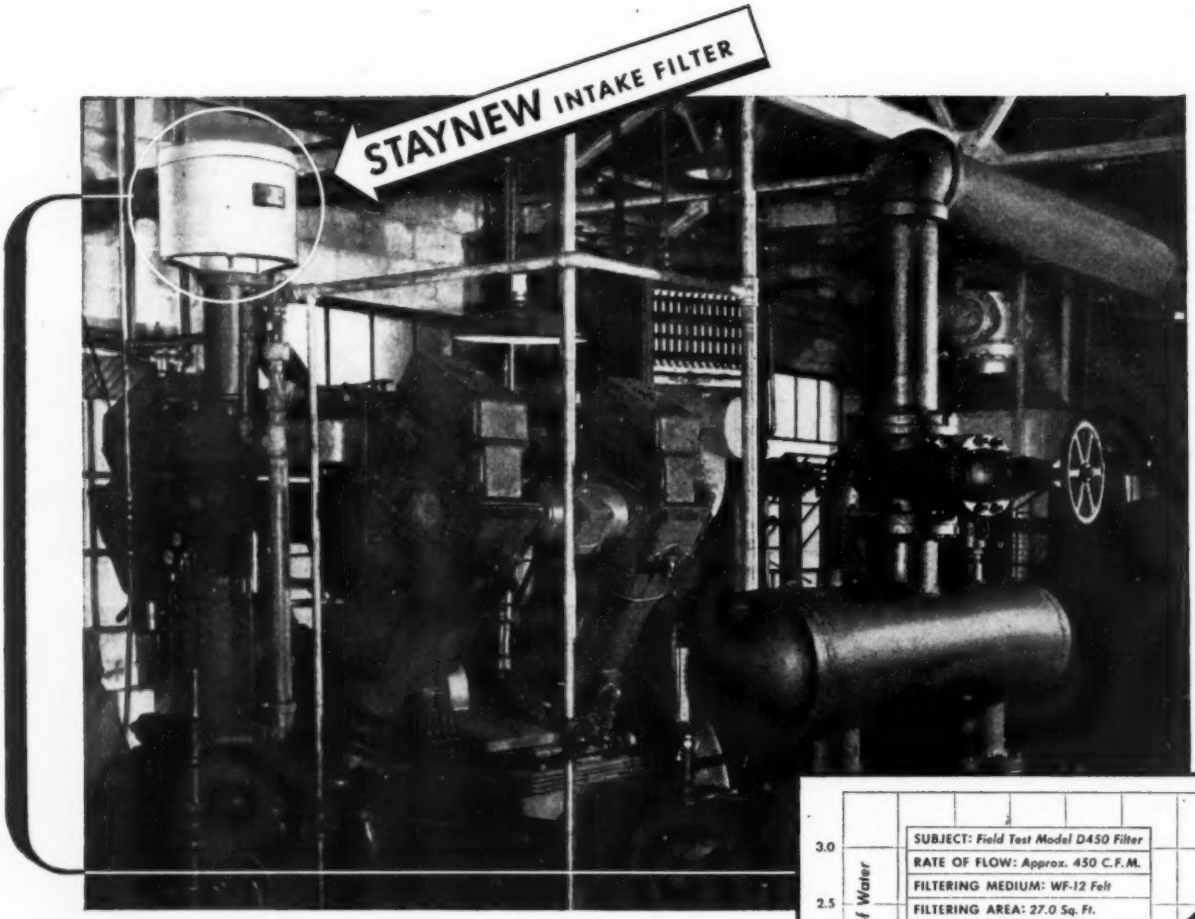
— The blades have large clearances and are double rim protected so that it is impossible for the blades to rub.

— Due to the generous blade clearances, it is not essential that frequent inspections of the thrust bearing be made.

For full details ask for Bulletin S-116.

T-1160

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



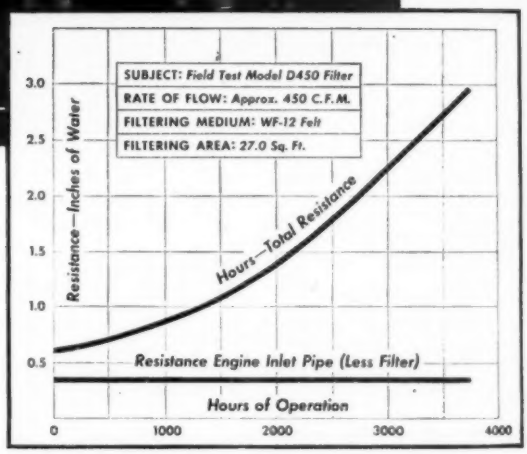
3761 HOURS CONTINUOUS OPERATION WITHOUT ATTENTION

Yet Filter Resistance Is Only 2.73 Inches of Water

This filter, installed on a Diesel-powered compressor, operates under unusually severe conditions. Intake air is heavily loaded with dust and oil; the dust due to the close proximity of a railroad siding where bulk lime, sand, and coal are handled—the oil to two additional Diesel-powered compressors operating in the same room.

Such a case history is not unusual. Reports are frequently received of Staynew Filters operating under less severe conditions for two or more years without attention—with the initially high efficiency rising as dust load increases.

Ease of cleaning as well as infrequency of cleaning is also an important feature, requiring only a few minutes with the specially designed Staynew Cleaning Nozzle.



More and more experienced operators of compressor and engine equipment specify Staynew Intake Filters—not only because of the minimum attention required, but also because these filters:

- ★ **Provide positive protection**
- ★ **Require no pre-coat or filter aid**
- ★ **Are unaffected by extremes of temperature**
- ★ **Permit use of oversize filters (air velocity not critical)**
- ★ **Are ideal for use with carbon ring compressors**

STAYNEW PROTECTOMOTOR FILTERS

DOLLINGER CORPORATION

(Formerly Staynew Filter Corporation)

23 CENTRE PK., ROCHESTER 3, N.Y.

Representatives in Principal Cities

Silver ANNIVERSARY 1920-1945

Specialists IN STEEL CASTINGS FOR VALVES—FITTINGS

● A sharp upswing in temperatures and pressures began nearly half a century ago. The need for cast steel valves and fittings became apparent. And that's when Reading began to specialize in *pressure* steel castings.

Early development was a matter of experimenting, recording experience and studying the records. But, as pressures and temperatures continued to rise, the demand was for ever higher standards in valves. Reading met the challenge with improved manufacturing methods. Melting processes were refined from converters to open hearth furnaces, then to electric furnaces. Control and investigational methods, such as photomicrographs, radiography, new methods of sand-testing and slag control were developed and improved.

Such developments produced castings in either carbon steels or alloys to use in valves to meet today's exacting requirements—valves and fittings which safely and reliably handle present-day high temperatures in the steam services and the gases and oils of the petroleum industry.

R-P&C offers you a single responsible source for bronze, iron and steel gate, globe, angle and check valves—cocks and Lubrotite gate valves—bar stock valves—cast steel fittings—D'Este Automatic Regulating Valves.

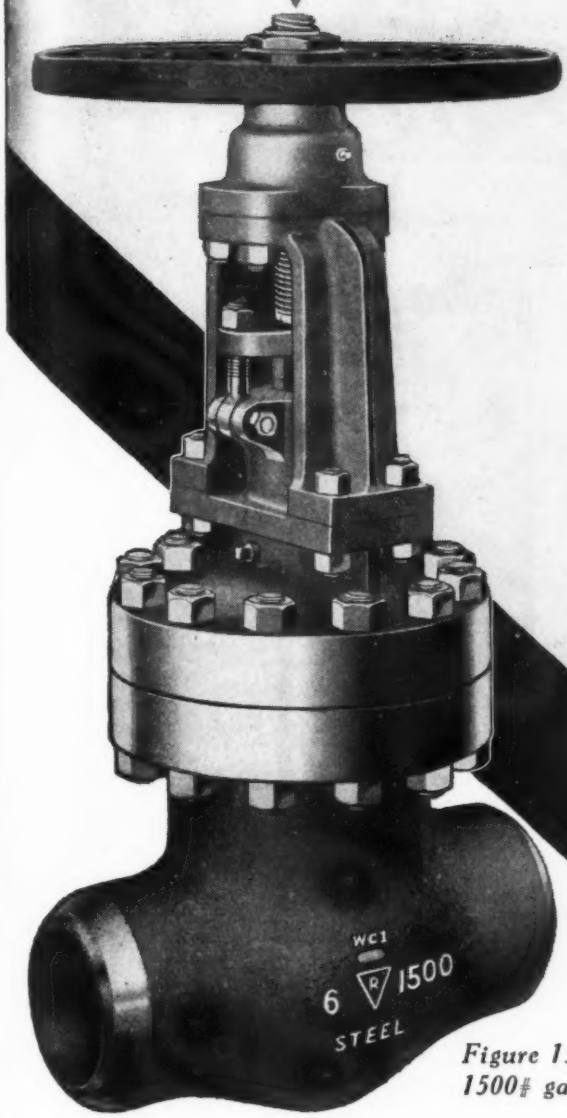


Figure 15004
1500# gate valve

READING-PRATT & CADY

MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE AUTOMATIC REGULATING VALVES

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READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

- A damper that is TIGHT!
- A damper that makes by-passes practical.
- A damper that gives you absolute flow control.
- A damper that is as adaptable to old installations as it is to new ones.
- A damper that solves capacity, "outage," maintenance and other problems.
- A damper that pays for itself—by actual *proof.*
- A damper that makes possible these results through a new principle of design never before used. The name? HEACON DAMPER!

WRITE FOR HANDBOOK

Get the facts! See where and how Heacon Dampers save money, increase efficiency on many types of applications. You'll find this booklet interesting, helpful, informative. Write for it today!

THERMIX ENGINEERING COMPANY

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FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

HEACON GIVES CONTROLLED FLOW

1. MORE RELIABLE OPERATION
2. INCREASED CAPACITY
3. REDUCED MAINTENANCE
4. GREATER FLEXIBILITY
5. HIGHER EFFICIENCY
6. BETTER REGULATION
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8. QUICKER STARTING
9. SAFER OPERATION
10. CLEARANCE WITHOUT LEAKAGE

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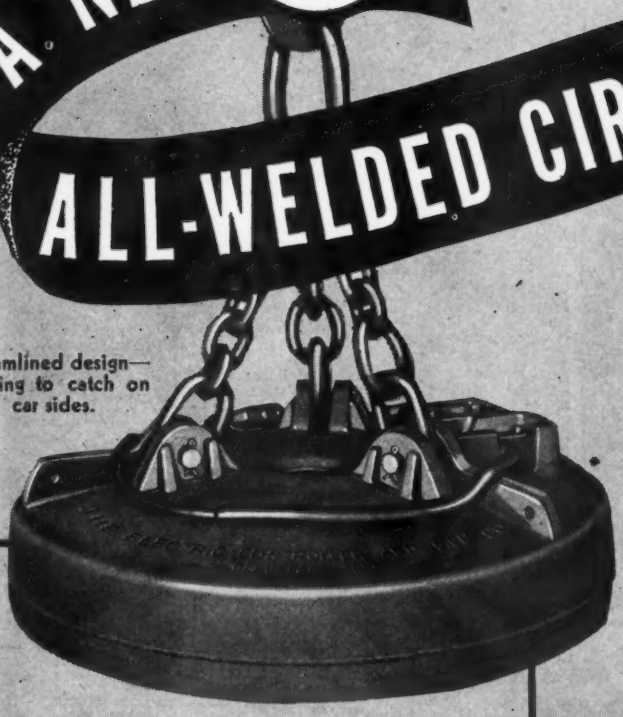
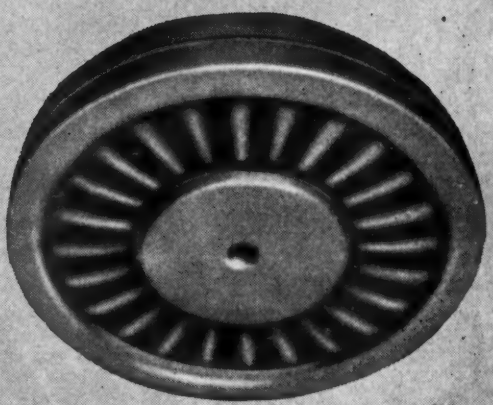
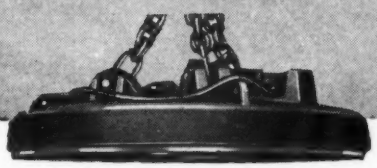
A NEW E&M ALL-WELDED CIRCULAR LIFTING MAGNET



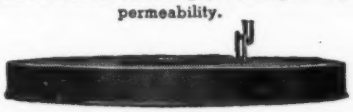
Streamlined design—nothing to catch on car sides.



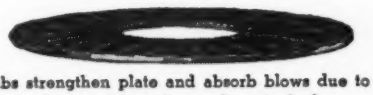
Bottom view showing heavy pole shoes welded securely in place.



Special low-carbon steel magnet-housing having high permeability.



Continuous welds at the outer and inner edges seal the coil-case into the magnet-housing.



Heavy ribs strengthen plate and absorb blows due to impact when magnet is dropped on stockpile.

Center pole of wear-resisting, high-permeable steel, accurately machined for snug fit with magnet-housing. Outer pole-shoe ring of tough steel having both wear-resisting and high permeability qualities.

THIS ADVANCED DESIGN OFFERS IMPORTANT ADVANTAGES:

GREATER LIFTING CAPACITY because (1) elimination of outer pole shoe bolt-recesses permits *full diameter coil* and (2) welding insures *permanent contact* between magnet-housing and the pole shoes.

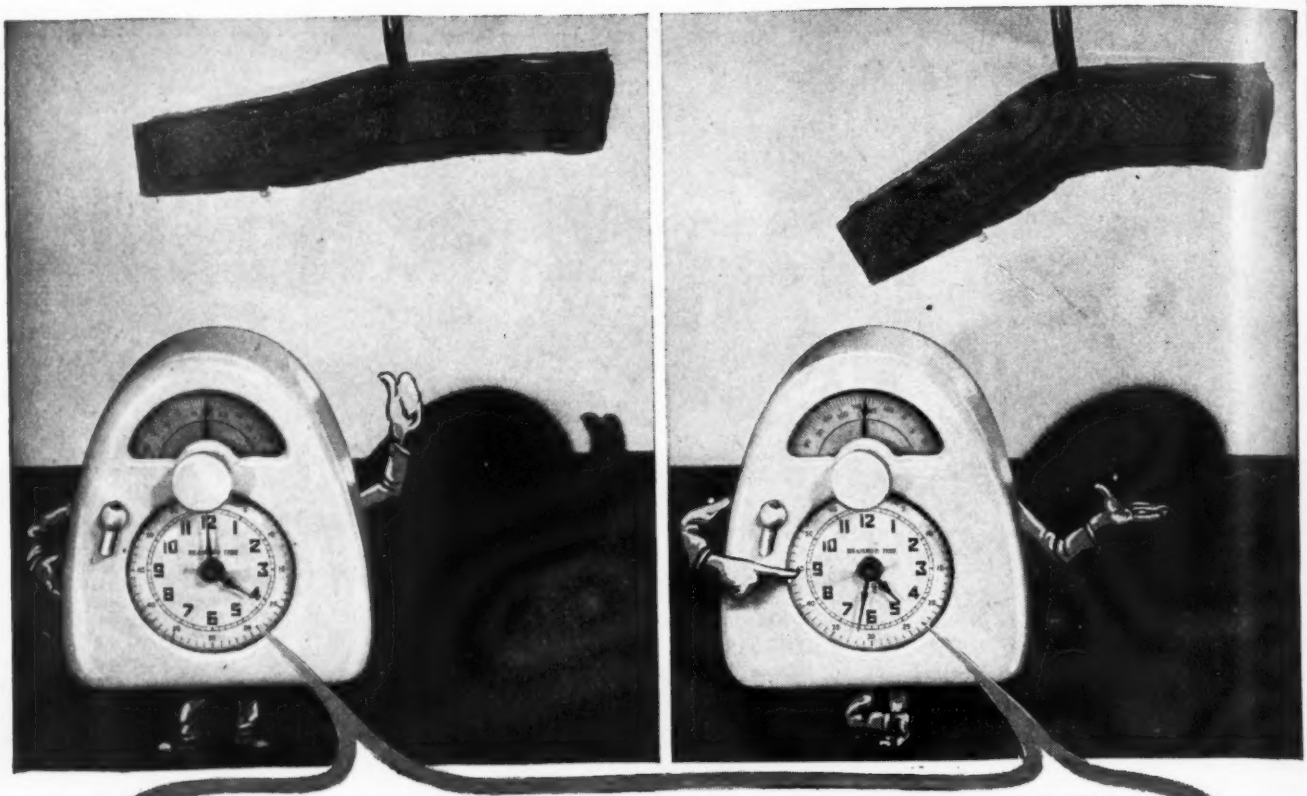
PROTECTION AGAINST MOISTURE getting into the magnet-winding because it is *hermetically sealed by continuous welds.* Suitable for underwater salvage work—in cooling pits—and other applications where moisture is excessive.

HIGH TEMPERATURE INSULATION. All sizes of this SW Magnet use strap copper wound on a mica-insulated spool. The insulation between turns is asbestos tape impregnated with a new *thermo-setting compound—No. 282.* The coil, in its metal-enclosed case, is also filled with No. 282 and baked to set the compound. In this form, No. 282 does not melt, yet is resilient.

Write for booklet 900, giving complete description.

The ELECTRIC CONTROLLER & MANUFACTURING CO.

2698 E. 79th ST. CLEVELAND 4, OHIO

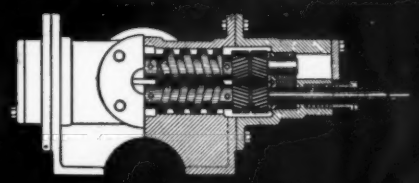


"Do you pump stuff as THICK as this?"

A solid at ambient temperatures, Cellulose Acetate's visocity is still over 10,000 S.S.U. when heated to process temperature. Yet Sier-Bath Screw pumps force this plastic through extruders and into molds. Even when handling such thick semi-liquids, Sier-Bath Screw pumps need neither heavy foundations nor deep bolting. Their operation is pulseless, vibrationless.

In fuel oil service, Sier-Bath Screw Pumps' smooth flow prevents "puffy" firing, improves boiler efficiency, reduces tip cleaning. High in efficiency, low in maintenance, less affected by head, Sier Bath Screw Pumps are built to closer tolerances. They are the only screw pumps with anti-friction roller bearings as standard design. Removable liners are available. Write for bulletin.

Only Two Moving Parts



Occasional re-packing can be done while pump is running because there is no pressure on the gland. End to center fluid movement eliminates thrust bearings. Self-centering timing gears prevent side wear of pumping screws resulting from screw contact. No valves—therefore no trouble.

For ACETATES • ASPHALTS • BRINES
BUNKER C FUEL OIL • CELLULOSICS
GREASES • MOLASSES • SYRUPS

PUMP DIVISION

Sier-Bath Gear Co. Inc.

SIER-BATH GEAR COMPANY, Inc., 9254 HUDSON BLVD., NORTH BERGEN, N. J.

WHY DO I PICK *Square D* SAFETY SWITCHES?

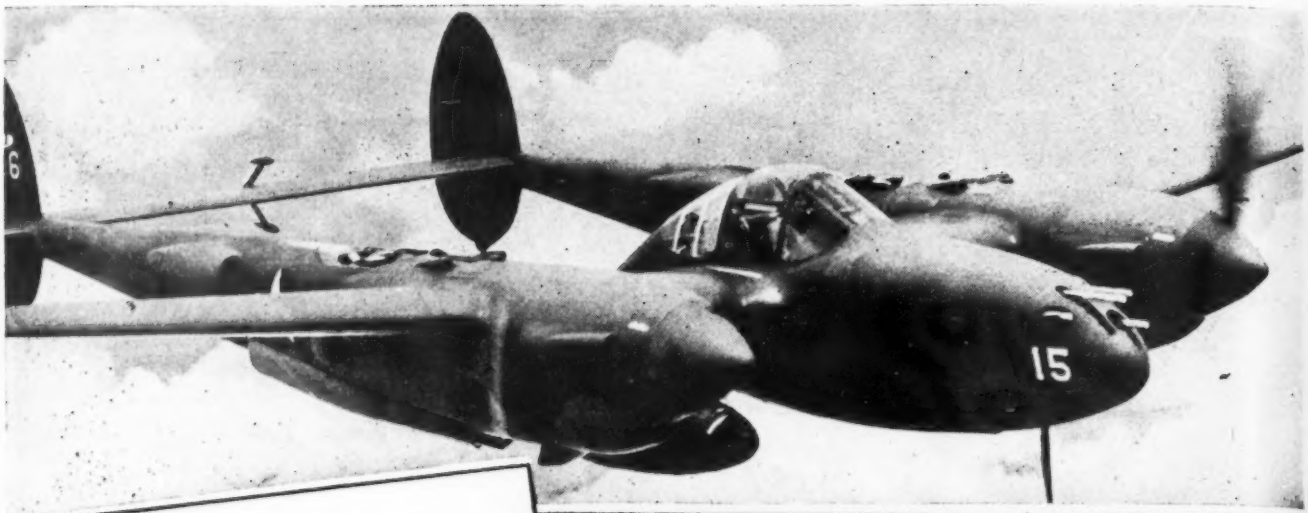
• Guess there are two or three reasons. Don't know offhand, how I'd rank 'em in importance, but they all add up. For one thing, Square D makes a pretty darn complete line of switches. During the past thirty years I've run into setups that called for about every type and size there is —and Square D hasn't let me down yet.

Another thing—Square D's got a crew of design engineers who know the score. Haven't met 'em, you understand, but you can judge 'em by what they put in their switches and not go wrong.

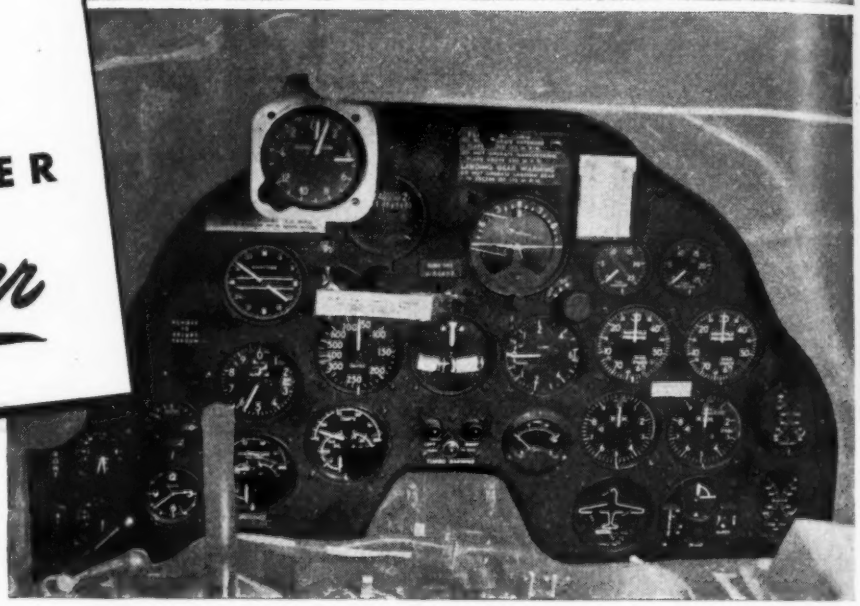
Then again, maybe I'm like a guy I know. Whenever he's in a strange town and doesn't know where to eat, he always looks for the place with the most folks. He figures that's a pretty good steer to good grub. Apply that kind of reasoning to safety switches and you can get only one answer. Maybe you've noticed—you run into that D emblem *everywhere*.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



In the air FLUID POWER *takes over*



A P-38 pilot knows the proved efficiency and reliability of Fluid Power . . . many of those dials on the instrument panel in front of him are telling a constant story of Fluid Power at work.

Wing flaps, ailerons, radiator flaps, landing gear, brakes—all are Fluid Power operated and controlled in the P-38. In addition, engine primers, fuel tank selectors, together with fuel, oil, vacuum and oxygen systems, are functioning components of the ships as a result of Fluid Power Engineering.

*The Parker designed standard aircraft tube fitting. Patented.

For more than twenty years . . . from the peace time years of aviation pioneering through the wartime years of mass airplane production . . . Parker tube fittings, valves and related products have won the unqualified endorsement of aircraft builders everywhere.

The tube fittings used in the P-38 are manufactured according to the Parker Triple Coupling* design. Parker engineering leadership has been recognized by the Army and Navy in the adoption of this basic Parker design as the current standard for all aircraft tube fittings.

In the aircraft industry the name "Parker" signifies precision workmanship, reliable quality and engineering perfection. This same reputation distinguishes Parker products used in every industrial Fluid Power application.

While working under the stringent design and performance requirements of aircraft building these many years, the Parker organization has uncovered many new Fluid Power possibilities which have been successfully introduced into new and diversified industrial applications. There is doubtless one to fit your needs. Address—The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES

FLUID POWER PRODUCTS FOR ALL INDUSTRY

When you buy

A *Superior* DIESEL

you buy the finest

Superior Installation in Large Midwestern Public Utility

SUPERIOR DIESELS • Marine • Stationary • Locomotive

Superior **ENGINES**

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THE NATIONAL SUPPLY CO.

Plant and General Sales Office:

Springfield, Ohio

THE GARLOCK GUARDIAN GASKET

RUGGED!

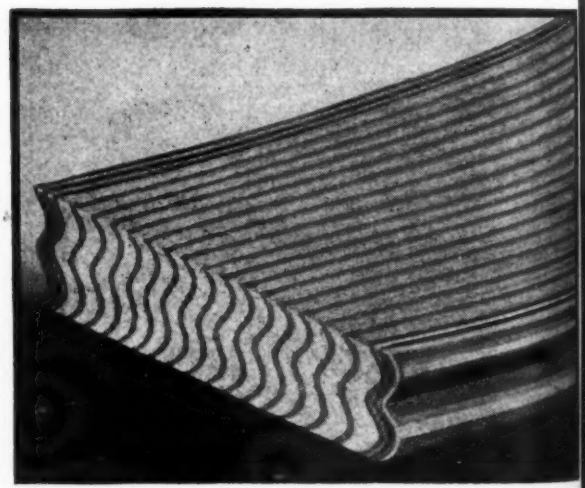
RESILIENT!

RELIABLE!

Safety against extreme temperatures and pressures. Metal and asbestos are the only materials used in the construction of Garlock Guardian Gaskets. They are unaffected by temperatures or pressures encountered in any gasket installation.

Resistance to gases and liquids. Garlock Guardian Gaskets are protected on their inner and outer edges by a double thickness of metal which forms an impregnable barrier to the destructive action of gases and liquids.

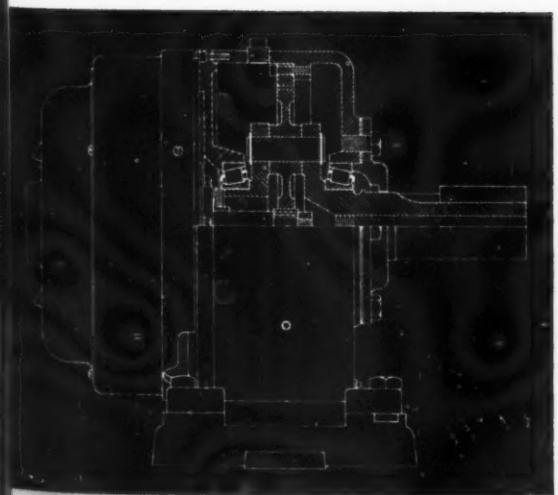
Tight joints under changing temperature conditions. Because of their unique structural design, Garlock Guardian Gaskets adjust themselves instantly and repeatedly to expansion and contraction due to temperature changes or vibration.



THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK

NEW JENSEN POWER UNITS USE TIMKEN BEARINGS



TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

These compact motor-reducer units are unique in that the speed reduction is effected by planetary gears.

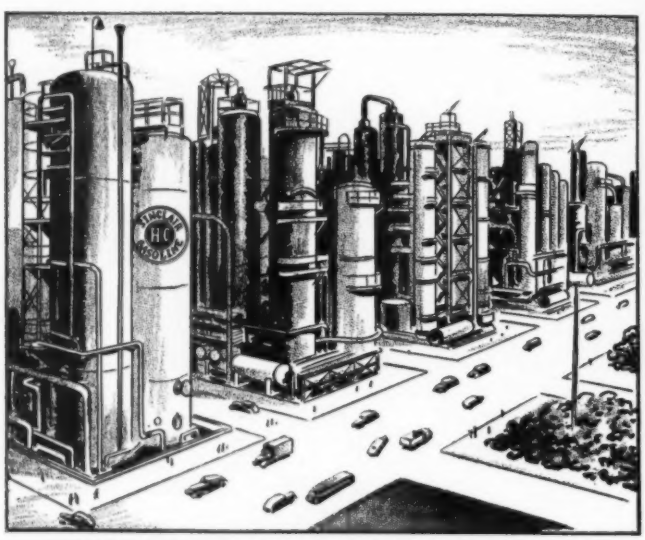
A reduction of 10 to 1 is obtained, the low speed shaft operating at approximately 175 R.P.M. This shaft is mounted in two large Timken Tapered Roller Bearings which prevent power loss by eliminating friction; carry radial, thrust and combined loads with ample reserve capacity; hold the shaft in precise and permanent alignment; and greatly simplify lubrication.

The units are made in eight sizes providing a power range of from ½ H.P. to 10 H.P. inclusive. The manufacturer, Jensen Brothers Mfg. Company, Coffeyville, Kansas, is widely known as a producer of heavy-duty oil field equipment, has had years of experience with Timken Bearings and knows they can be depended upon to do an outstanding job under all service conditions.

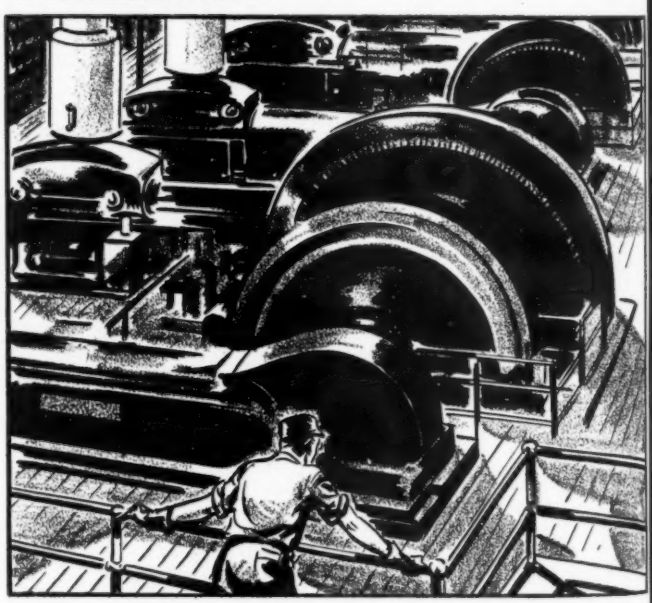
It pays to use Timken Bearings in any kind of machinery —but be sure the trade-mark "TIMKEN" is stamped on every bearing that goes in your product. The Timken Roller Bearing Company, Canton 6, Ohio.

Do you know that . . .

A LINE OF DRUMS END TO END LONG ENOUGH TO REACH TWICE AROUND THE EARTH WOULD BE REQUIRED TO HOLD THE BILLIONS OF GALLONS OF SINCLAIR FUEL AND LUBRICANTS SOLD LAST YEAR.



SINCLAIR REFINERIES HAVE MANUFACTURED MILLIONS OF BARRELS OF 100-OCTANE GASOLINE FOR THE ARMED FORCES. SINCLAIR AVIATION GASOLINE WILL AID FLYING ON NATIONAL AND INTERNATIONAL ROUTES.

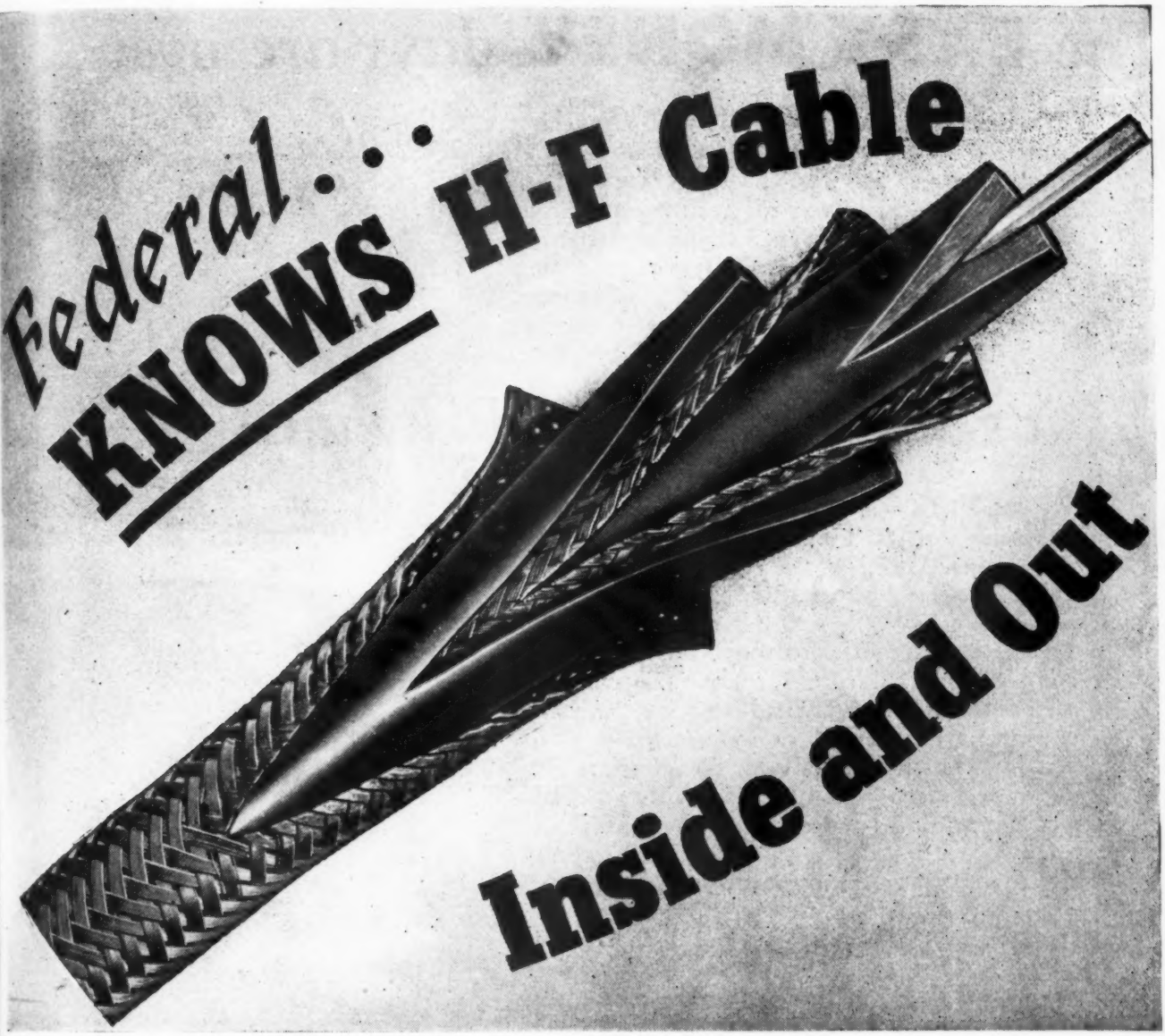


LUBRICATION FOR FULL DELIVERY OF POWER UNDER CONTINUOUS HEAVY DUTY OPERATION IS PROVIDED BY SINCLAIR STEAM CYLINDER AND VALVE OILS. THEY SUIT ALL ENGINE DESIGNS AND OPERATING CONDITIONS.

SINCLAIR IS EQUIPPED TO SERVE YOU BETTER!

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Federal... KNOWS H-F Cable Inside and Out



From inner conductor to outer covering . . . Federal really knows high-frequency transmission lines.

And this knowledge was not easily won. As the pioneer in the field Federal not only developed over 80% of all h-f cable types in use today . . . but developed most of the equipment needed to test them.

Attenuation, high-voltage, dielectric and balance testing equipment, velocity of propagation, braid-resistance and electrical length meters . . . were all Federal-*engineered* to fit specific requirements.

That's why it's logical to turn to the acknowledged leader in the field for the finest in h-f cables, specialty-engineered harnesses and cable assemblies.

Where requirements are critical . . . for transmission lines with special characteristics . . . for custom-built and engineered harnesses and cable assemblies . . . take your high-frequency transmission problems to Federal.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

The **EASY MONEY** *days are over . . .*

Wartime willingness to pay virtually anything for needed facilities is at an end. The cost-plus contract which fostered laxity and extravagance is dead . . . and its passing is not mourned either by the able and efficient engineering-construction firm nor by the conscientious buyer of processing plants and units who knows industry again must function within a highly competitive economy.

. . . it's time to call in Pritchard

Pritchard has never condoned cost-plus even on the ground of war's urgency, preferring to keep its organization trim and keen, geared to the cost-conscious necessities of normal times.

Pritchard has recently completed and is at present completing very large turn-key contracts on which the profit, overhead and contingencies consistently amounted to a remarkably small percentage of the total. These low costs are evidence of thorough competence, with no deadwood in personnel and no delays in performance . . . evidence also of the vast experience imperative to undertaking and executing such projects.

"Get a TURN-KEY BID from Pritchard" is sound business . . . whether for the complete service, design through construction, or for any part that best fits your needs.

J.F. Pritchard & Co.

ENGINEERS AND CONSTRUCTORS

FOR THE CHEMICAL • PETROLEUM • GAS AND POWER INDUSTRIES

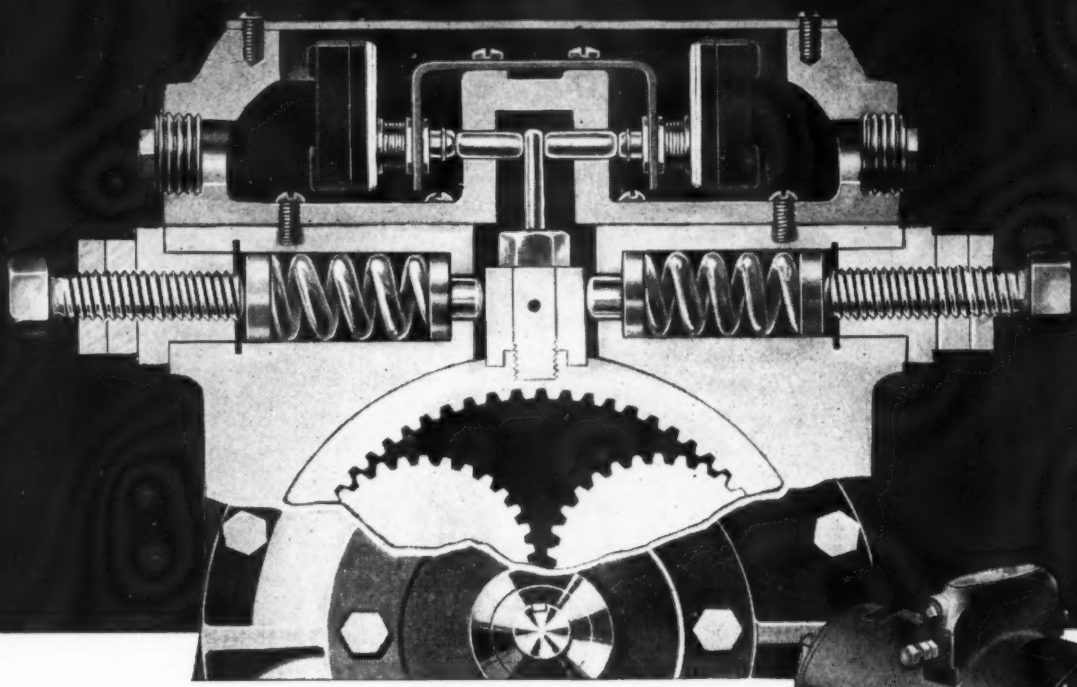
Manufacturers of Mechanical and Atmospheric Cooling Towers

FIDELITY BUILDING, KANSAS CITY 6, MO.

NEW YORK • PITTSBURGH • DETROIT • HOUSTON • ATLANTA • TULSA • DENVER • SALT LAKE CITY • EL PASO • OMAHA • MEXICO CITY

Instantaneous

OVERLOAD PROTECTION



Responds to overloads more quickly than electrical thermal relays

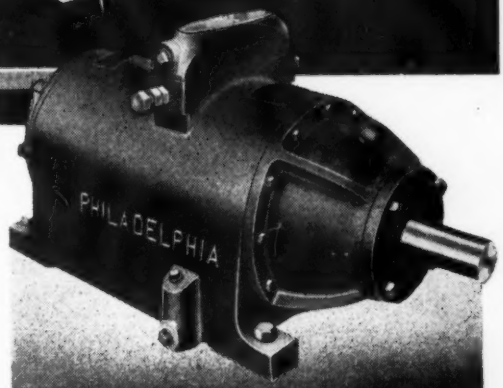
The PlaneTorque is a feature that can be incorporated into any MotoReduceR—*the built-in motor and speed reducer*—to protect both the driven machinery and the drive unit from overloads.

By direct mechanical action of the overload, motor current is automatically and instantly cut off when a pre-determined limit is reached. This action is quicker than electrical thermal relays provide. With fuse protection the fuses must be selected to carry the starting current of the motor. Therefore the protection during the running period is not adequate.

The PlaneTorque can be cut out during the starting period merely by holding down the starting button but will become operative during the running period when the button is released.

To restart the PlaneTorque-MotoReduceR after overload cut-off only removal of the excessive load is necessary . . . a big time saving feature.

For applications such as stoker drives, conveyor drives, mixers, roll drives, etc. . . . investigate the PlaneTorque MotoReduceR. Get our Catalog M. R. 40 for further details.

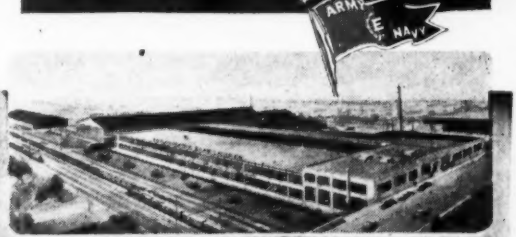


Philadelphia

PLANETORQUE MOTOREDUCER

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls

"Flexitallic..."

REG. U. S. PAT. OFFICE

Flexitallic C-G (Compressio Gauge) gaskets illustrated ar available for all temperature and pressures including th 2500 ASA flange standards.

THE SOLUTION TO 1001 GASKET PROBLEMS

When Flexitallic originated resilient spiral-wound gasket construction over a third of a century ago, working pressures ranged from 150 to 300 lbs. Today, pressures of 1500 lbs. (and even 2500 lbs.) are not uncommon. Extremely high temperatures and difficult conditions involving liquids, gases, or chemicals are frequently encountered—yet, through a constant process of development, Flexitallic has solved each new problem as it arose—and has anticipated many of them. No other company has concentrated research and engineering so fully on one type of gasket construction. None other can match Flexitallic in offering a service geared to the most exacting of today's demands.

High or Low Temperatures
•
High or Low Pressures
•
Liquids, Gases, or Chemicals
•
Specifically designed for actual working conditions
•
All types and shapes for all pipe flanges and pressure vessels

Given the simple necessities of adequate seating surface and bolting, there is no gasket problem Flexitallic can't beat!

FLEXITALLIC GASKET COMPANY • 8th & BAILEY STREETS • CAMDEN, NEW JERSEY

ORIGINATORS OF THE SPIRAL-WOUND GASKET — SPECIALISTS IN SPIRAL-WOUND GASKETS EXCLUSIVELY FOR OVER A THIRD OF A CENTURY

BETTER THAN EVER!

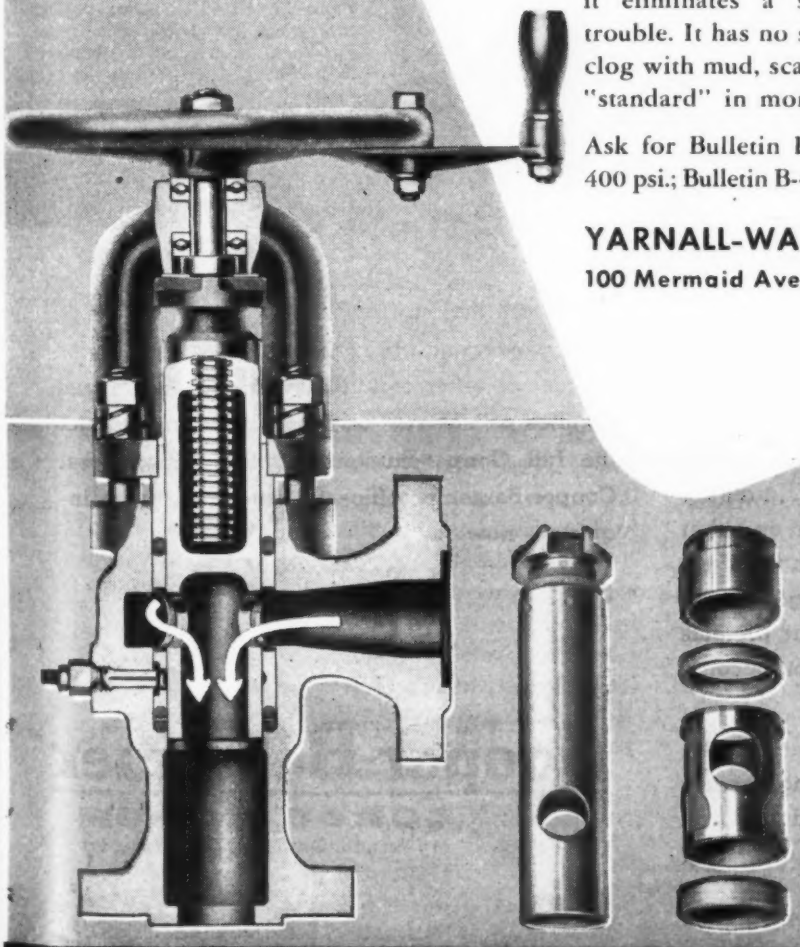
Constant metallurgical and mechanical research—aimed solely at improving boiler blowdown service—have made today's Yarway Seatless Blow-Off Valves literally "better than ever."

From the Yarway Research Laboratory have come such basic improvements as nitrided nitralloy sliding plungers and Neoprene-type packing rings. Both greatly increase the service life of Yarway valves . . . make them even more of a favorite among the nation's power plant operators.

The Yarway Seatless Blow-Off Valve has been hailed since its introduction because it eliminates a source of continuous trouble. It has no seat to score, wear and clog with mud, scale and dirt. Today it is "standard" in more than 12,000 plants.

Ask for Bulletin B-424 for pressures to 400 psi.; Bulletin B-432 for higher pressures.

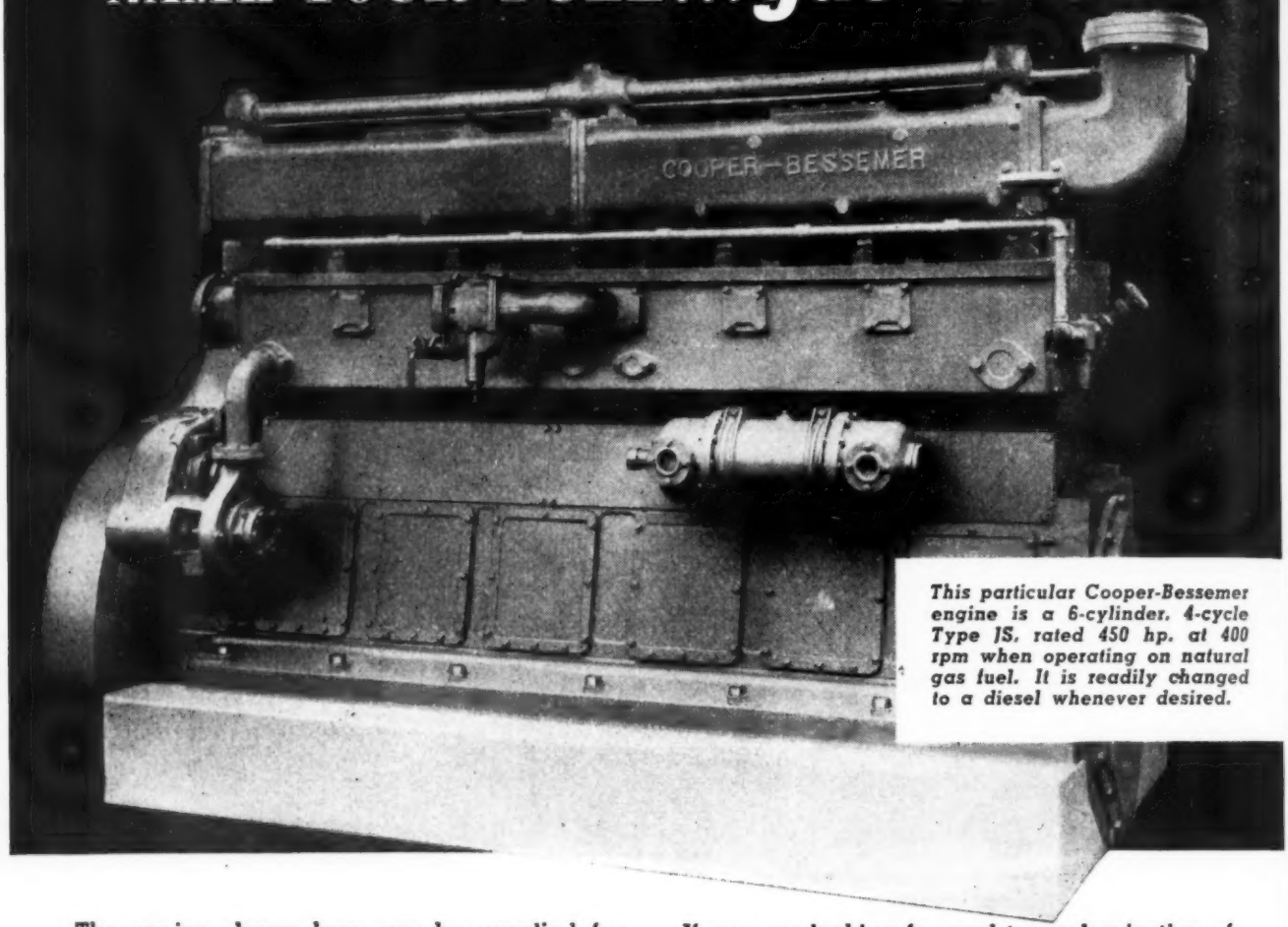
YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.



SEE YARWAY BLOW-OFF VALVES ...HEAR LOWELL THOMAS describe their design and application in the new 30-minute color and sound motion picture "There Is An Engineering Reason." Free for group showings. Write for details.

YARWAY BLOW-OFF VALVES

NAME YOUR FUEL... *gas or oil*



This particular Cooper-Bessemer engine is a 6-cylinder, 4-cycle Type JS, rated 450 hp. at 400 rpm when operating on natural gas fuel. It is readily changed to a diesel whenever desired.

The engine shown here can be supplied for either natural gas or diesel operation—whichever is the most economical choice in your locality. It is one of six Cooper-Bessemer stationary types ranging from 95 to 2000 horsepower.

All are long-life heavy duty engines . . . all are available for highly efficient operation on either fuel . . . and, what's more, conversion from gas to diesel or diesel to gas is surprisingly simple and entirely practical—a feature that protects investment should a changeover ever become economically desirable.

Always dependable, requiring little attention or maintenance, Cooper-Bessemer engines are enabling mills and other process industries in all parts of the country to cut their operating power costs to the bone.

If you are looking forward to modernization of your power set-up . . . if your local fuel resources or other conditions make diesel or gas engines a "natural" . . . then by all means get the full Cooper-Bessemer story. The nearest Cooper-Bessemer office will welcome your inquiry — now.

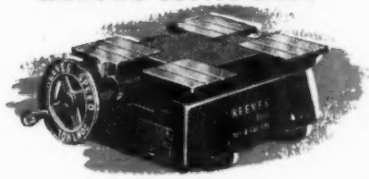
THE **Cooper-Bessemer** CORPORATION
Mt. Vernon, Ohio • Grove City, Pa.

NEW YORK WASHINGTON HOUSTON DALLAS TULSA SHREVEPORT LOS ANGELES ST. LOUIS SEATTLE

BUILDERS OF FINE ENGINES FOR 112 YEARS

How to convert any standard constant speed motor to a Low Cost *Stepless Variable Speed Drive*

1 **Mount Your Motor on This REEVES Motor Base**



Base is built in wide range of sizes to fit any standard constant speed motor up to 15 h.p. Includes sliding platform and handwheel for moving motor forward or back.

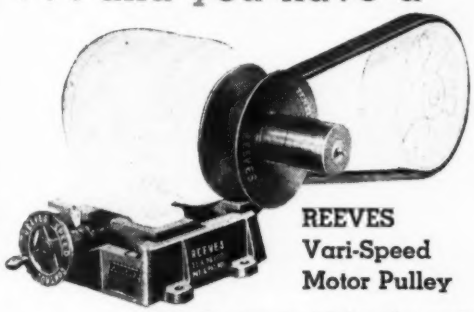
2 **Apply This Disc Assembly to Motor Shaft**

Assembly consists of two facing cone-shaped discs, one stationary, the other sliding laterally, and compression spring for mounting on extension shaft of motor.

3 **Connect to Driven Machine With This Special V-Belt**

Place specially designed REEVES V-belt between discs and over pulley on power input shaft of the driven machine. Adjust belt to minimum center. Anchor motor base.

. . . and you have a



REEVES Vari-Speed Motor Pulley

available in sizes to 15 h.p. for stepless speed adjustability within 4:1 range.

HOW IT WORKS: The operation of a REEVES Motor Pulley is extremely simple—yet it follows the time-tested REEVES principle of a V-belt traveling between the adjustable driving diameters of cone-shaped discs. By turning handwheel, motor is moved forward or back on base, varying the driving diameters of the discs. As motor is moved toward driven machine, belt rides higher between discs, thus increasing the speed transmitted. Turning handwheel in opposite direction reverses the operation. Any speed within range is accurately maintained.

WHAT YOU CAN DO WITH IT: The REEVES Motor Pulley is the simplest dependable method of providing infinitely variable speed adjustability to a driven machine. With this low-cost, easy-to-install equipment you can transform a machine with fixed speeds into a far more versatile production unit—one that is instantly responsive to every changing condition and work schedule. Install REEVES Motor Pulleys on your machines in service, and when you buy a new machine, look for the familiar REEVES handwheel that signifies REEVES-equipped.

SEND FOR THIS CATALOG

New, 96-page book gives complete information on this and the two other basic REEVES Speed Control units—the Variable Speed Transmission and the Motodrive. Ask for Catalog P-450.

REEVES PULLEY COMPANY, COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

Because They Resist Wear
and produce an excellent finish

HAYNES STELLITE Burnishing Rollers are widely used in railroad shops

More than 100,000 car axles have been burnished in one railroad shop with one set of HAYNES STELLITE burnishing rollers. In eight years of hard service these rollers of cobalt-base alloy have required no repair or maintenance, except lubrication.

HAYNES STELLITE rollers not only resist wear, but also retain their high polish, and burnish to a high degree of smoothness. And because they are essentially non-magnetic, they are unlikely to pick up steel particles that will mar the work.

HAYNES STELLITE alloys are used in many tough industrial jobs where hard, abrasion- and corrosion-resistant metals are needed. Our engineers will be glad to help you use them. For further information, write for the booklet, "Products of Haynes Stellite Company."

In HAYNES STELLITE Alloys you can get these advantages:

1. **Resistance to wear and abrasion.**
2. **Hardness even at red heat.**
3. **Good mechanical properties at high temperatures over long periods of time.**
4. **Resistance to atmospheric corrosion and corrosive chemicals.**
5. **Low co-efficient of friction.**
6. **Practically non-magnetic.**
7. **Available in the form of castings, small sheets, and welding rod.**

BUY UNITED STATES VICTORY BONDS AND STAMPS

ARMY E NAVY

HAYNES TRADE-MARK *alloys*

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Office and Works, Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa

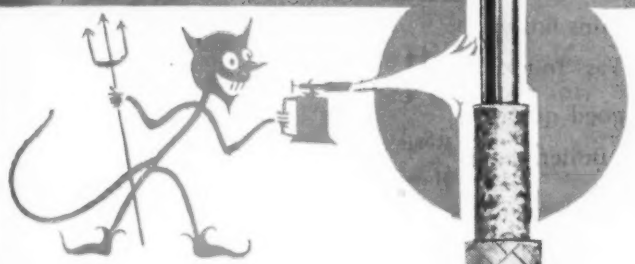
"Haynes," "Stellite," "Hastelloy," "Hascrome," and "Haystellite" distinguish products of Haynes Stellite Company.

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES

For those "hot spots" where wires and cables must be protected against flame, heat, oil, grease and corrosive fumes, specify National Electric's "NEasbestus." This wide range of asbestos and asbestos-varnished cambric insulated wires and cables is described at length in a 32 page booklet available on request.

"NEasbestus"

WIRES and CABLES for HOT SPOTS



ALL ASBESTOS WIRE AND CABLE

Sizes No. 18AWG to 1,000,000 CM.—For wiring rheostats, stoves, switchboards and electrical equipment exposed to heat or fire hazard. Also for general open wiring in hot locations. 300 and 600 volt ratings. Max. operating temperatures 200°C (392°F) and 125°C (257°F) respectively.

ASBESTOS-VARNISHED CAMBRIC CABLE

Sizes No. 18AWG to 1,000,000 CM.—For power circuits and general hot spot wiring in boiler rooms, steam tunnels, etc. 600 to 8000 volt ratings. Max. operating temperatures 110°C (230°F) and 91°C (196°F) respectively.

National Electric
PRODUCTS CORPORATION
Pittsburgh 22, Pa.

SHIPPED TO YOU

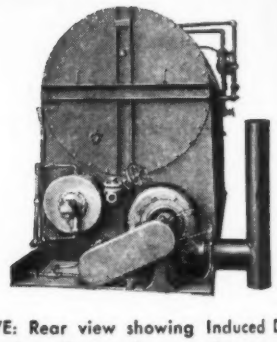
COMPACT

AND COMPLETE

ABOVE: The Dutton Econotherm Steam G[illegible] when uncrated — compact, complete and ready to run auto[illegible]. With fuel, steam and water lines are connected. Twice the power [illegible] the usual s[illegible] — no expensive installation costs.

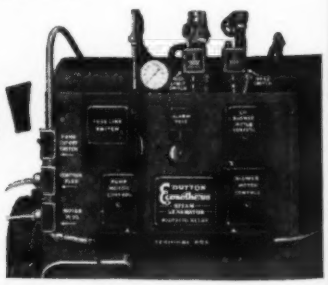
RIGHT: Fe[illegible]es that make the Econotherm ultra-[illegible]ent. 1 Oil-[illegible] gas burners [illegible] automatic ignition — highest [illegible] minimum fuel consump[illegible]. 2 Rotary Combustion — exclusive [illegible] for increased firing and quicker steaming. 3 Condensate Return System includes [illegible]k inside casing — automatically maintains normal water level and provides makeup water as needed. 4 3 Pass Induced Draft system for f[illegible] steam, uniform circulation and good quality steam without variati[illegible] in pressure or water level. 5 Boiler shell completely rock wool blanket insulated and covered with steel lagging.

WRITE FOR FULL DETAILS



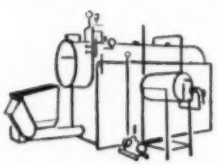
ABOVE: Rear view showing Induced Draft Fan and small vent pipe — no large, expensive stack necessary. Note streamlining and compactness.

Dutton ECONOTHERM
AUTOMATIC STEAM GENERATOR

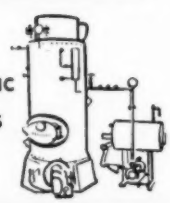


ABOVE: The Econotherm includes every instrument and control necessary for full automatic operation. Less supervision and greater efficiency.

DUTTON ECONOMIST HIGH PRESSURE BOILERS



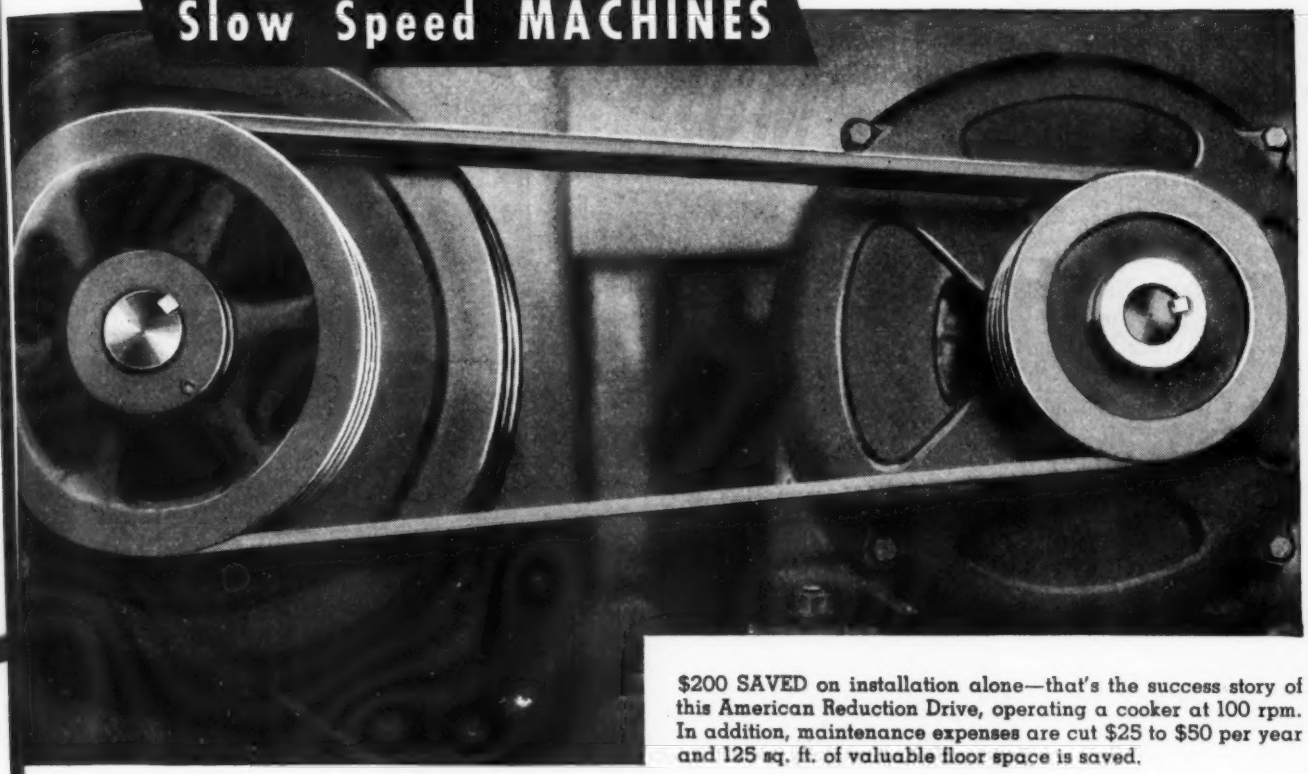
DUTTON AUTOMATIC VERTICAL BOILERS



PRESSURE VESSELS • HEAT EXCHANGERS • CONDENSERS

THE C. H. DUTTON COMPANY • 622 GIBSON STREET • KALAMAZOO, MICHIGAN

3 ways To CUT COSTS on Slow Speed MACHINES



$200 SAVED on installation alone—that's the success story of this American Reduction Drive, operating a cooker at 100 rpm. In addition, maintenance expenses are cut $25 to $50 per year and 125 sq. ft. of valuable floor space is saved.

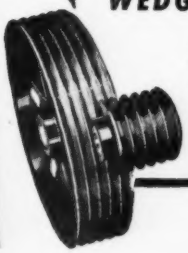
By equipping your slow-speed machines with American Reduction Drives, you get substantial three-way savings. Here's how:

1. Installing American Reduction Drives saves time, labor, and space. They mount as easy as a pulley—right on the shaft of the driven machine. No cumbersome supports or foundations are needed.
2. Maintenance is no problem at all with American Reduction Drives. Motor and gears are protected from damage—the primary belt drive absorbs the impact of shock loads.
3. Any motor can be used with American Reduction Drives. And speed-changes are quickly, easily made by simply altering the ratio of the primary belt drive—making possible any speed between 11 and 154 rpm.

Get complete information on these compact, lightweight drives. Write today for your copy of the American Reduction Drive handbook.

The American Pulley Company

4226 WISSAHICKON AVE., PHILADELPHIA 29, PA.



WEDGBELT SHEAVES

American Wedgbelt Sheaves are made to highest precision standards, of sound, strong materials. Accurately machined, carefully balanced, they assure true-running performance.

First National Bank, Baltimore, Maryland.

MORE SERVICE... with FEWER elevators

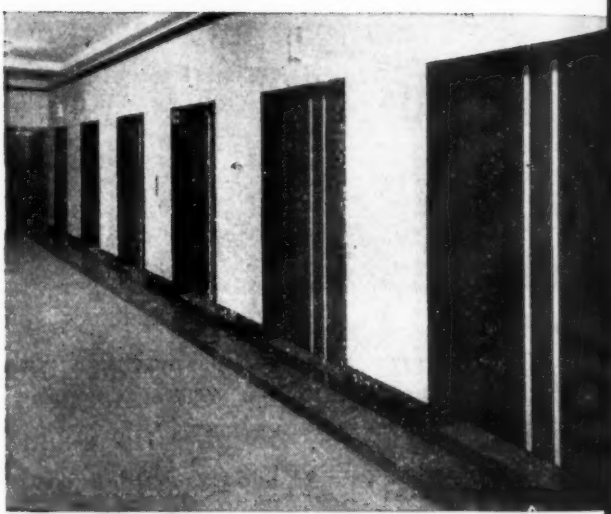
THE First National Bank Building of Baltimore, Maryland is another of the many buildings in which elevator modernization by Otis resulted in better service at less operating cost.

Originally, this building was equipped with six Car Switch Controlled Gearless Elevators. All six elevators had to be operated to handle the building traffic.

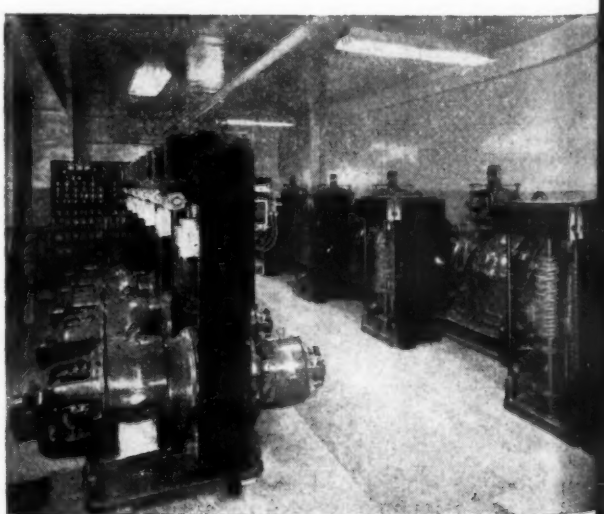
These elevators were changed over to Otis Peak Period Control and now only five elevators are required to handle the traffic during the morning, noon, and evening peaks. For the normal traffic requirements only four elevators are required.

Whatever your transportation problems . . . regardless of the height or type of your building . . . your Otis representative is ready to consult with you or your Architect.

For the finest in vertical transportation tomorrow, call your Otis representative TODAY.

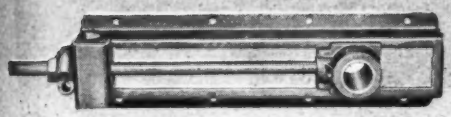
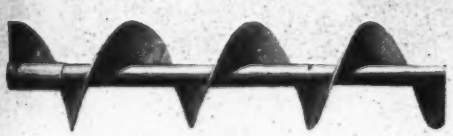
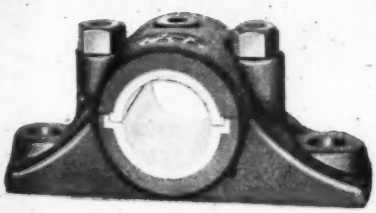
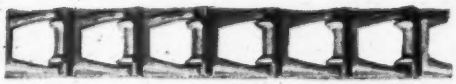


Partial view of 1st Floor lobby showing elevator entrances.



Partial view of the Penthouse Machine Room after Otis Modernization.

MADE TO FIT ★ ★ ★ ★ ★ ★ BUILT TO LAST

The surest way to keep conveying and elevating equipment going at full tilt is to use Jeffrey chains and genuine replacement parts (a few are pictured here). They're made to the same high standards that govern original equipment.

For maintenance items or for complete material handling systems . . . rely upon Jeffrey.

WHAT WE MAKE

BARREL PACKERS
BUCKET ELEVATORS
CAR PULLERS
CHAINS
CONVEYORS
COOLERS
CRUSHERS
DRYERS
FEEDERS
PULVERIZERS
SCREENS
SHREDDERS
SKIP HOISTS
TRANSMISSION MACHINERY
WEIGH LARRIES

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

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Now You Can Start The Savings .. WITHIN 60 DAYS!

No longer must you put up with wasteful leaks in steam, air, oil or water line valves because of the necessity of shutting down production for long periods to replace them. No longer must you keep an expensive maintenance crew on deck to make valve replacement installations. No longer must you continue to buy new, expensive valves over and over again, only to see them develop wasteful leaks.

BECAUSE

No longer must you wait an indefinite period for delivery of your new Dexter Valve Reseating Machine.

The Dexter Equipment makes it possible and practical for one man to reseat a leaky valve right on the line in just a few minutes and make the job perform better than a new valve. Here is a sure saving in just a short period of many times the original cost of the Dexter Reseating Outfit.

Now that our non-military manufacturing facilities are catching up with our back orders, you can actually start these savings in your own plant within 60 days after we receive your order. Send it today!

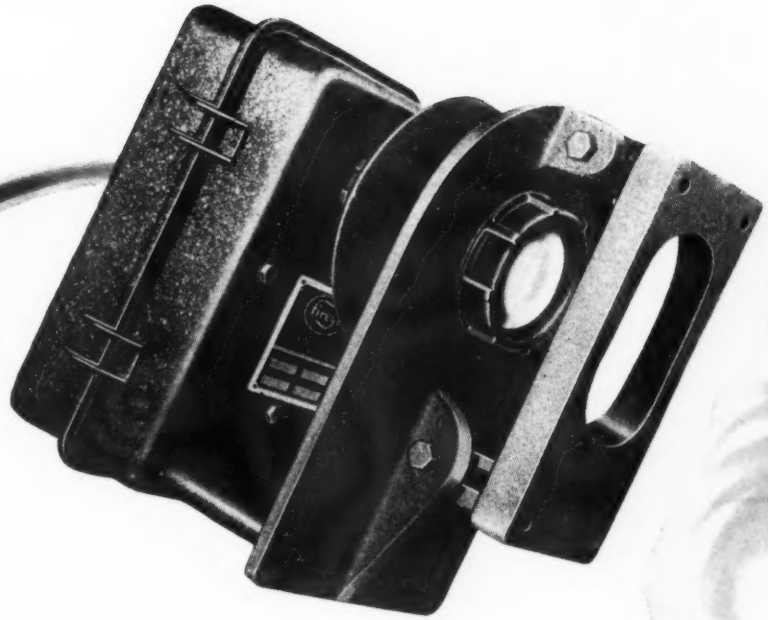
•

We'll gladly help solve your leaky valve problems if you'll write us complete data including make, size, type and material, and whether water, air, oil or steam. We'll explain the Dexter answer. 27

DEXTER VALVE RESEATING

For Globe, Gate, and Pump Valves

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS



EXPLOSION PREVENTER

Postwar model . . . *but now!*

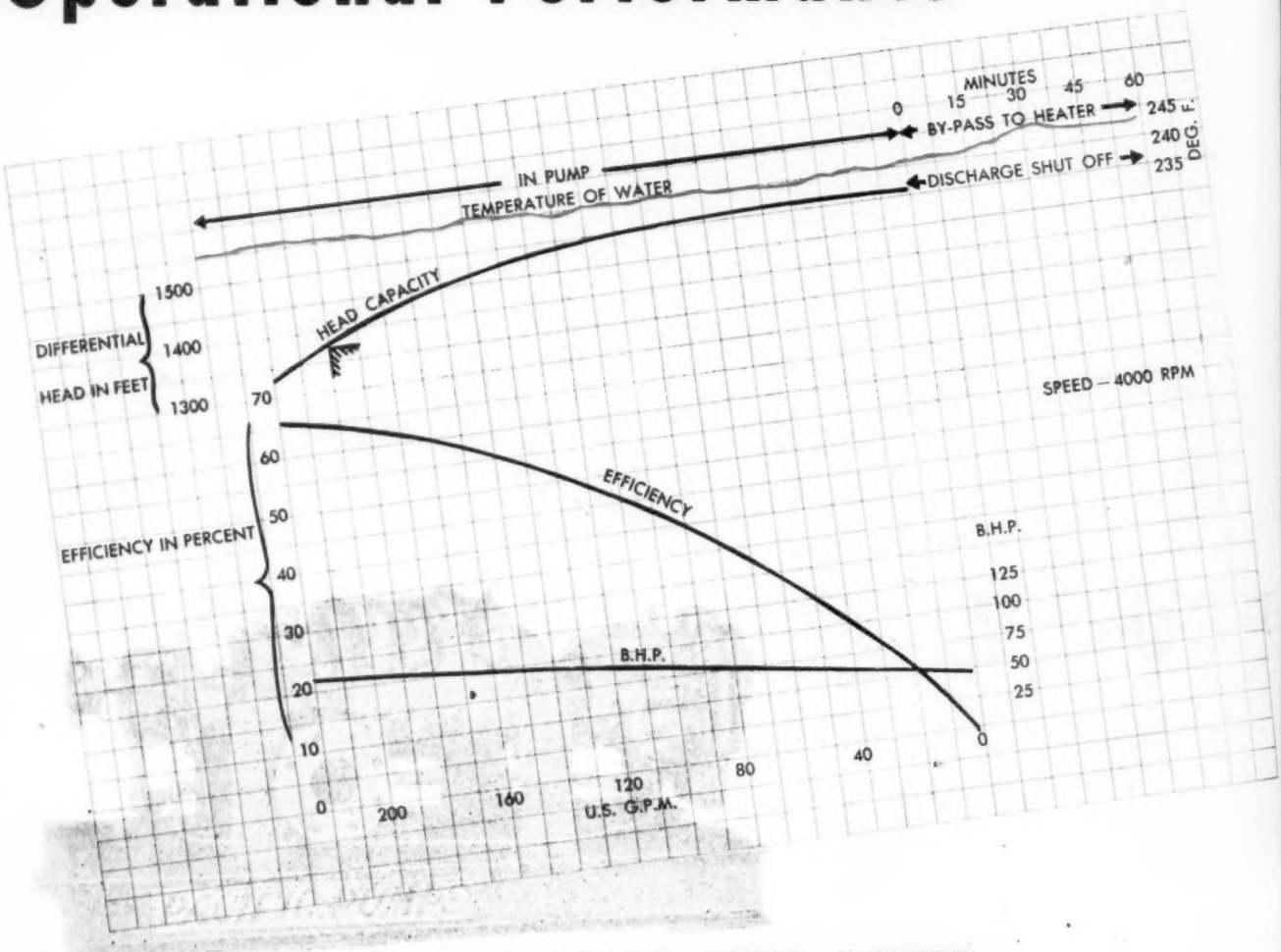
There's just one reason for putting a Flame Failure Safeguard on an oil or pulverized coal burner — to prevent an explosion. No control which does not react instantaneously to flame failure can provide full protection. It is the few seconds of delay lost between flame failure and fuel cut-off that charges the combustion chamber with potential destruction. Equipment that depends upon changes in temperature or in flame characteristics, such as electrical conductivity, must be ruled out in the dependable system. Only the surest control is worthy of the responsibility of protecting your property. Fireye is a *Photoelectric* Flame Safeguard. It is actuated by the direct light of the flame itself — but that is not all! Fireye is *photoelectric* in operation — does not depend on converting the light into heat in a mechanical gadget. Fireye sees the flame — acts instantly upon flame failure to cut off fuel and sound an alarm. Fireye mounts outside the boiler, looks through a window, is removed from destructive heat. Fireye is the flame safeguard of the future — proved and ready for you now.

Combustion Control Corporation • **Cambridge 42, Mass.**

District Offices in all Principal Cities

photoelectric fireye flame safeguard

Operational Performance



PACIFIC MODEL JB BOILER FEED PUMP

SUSTAINED EFFICIENCY

because the short bearing span and the rigid shaft contribute to the maintenance of original clearances over long periods of continuous severe operation.

ECONOMICAL OPERATION

because engineered balance prevents undue vibration—impellers dynamically balanced—diffusers balance radial thrust —Pacific Stationary Floating Seal balances end thrust.

PACIFIC STATIONARY FLOATING SEAL

—makes positive automatic provision for by-pass return to feed water heater to prevent overheating of water when carrying light loads or operating with closed discharge

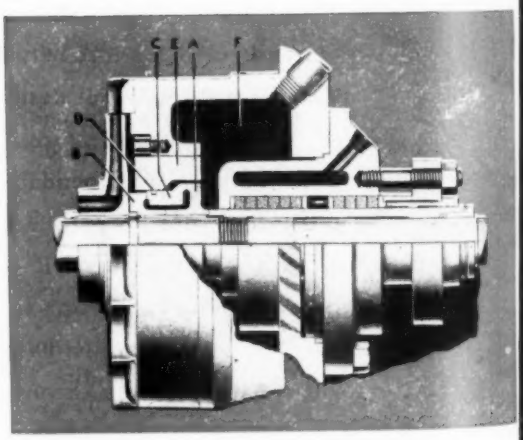
—reduces high pressure back of last stage impeller to suction pressure in stationary floating seal chamber and maintains suction pressure on discharge end of stuffing box.

Write for Pacific Pumps Bulletin 80

PACIFIC PUMPS INC., *Huntington Park, California*

One of the Dresser Industries

Export Office: Channin Bldg., 122 E. 42nd St., N.Y.



(A) Low Pressure Seal Plate. (B) High Pressure Seal Plate. (C) Seal Bushing. (D) Piston Ring. (E) Seal Housing. (F) Chamber with By-pass Line.

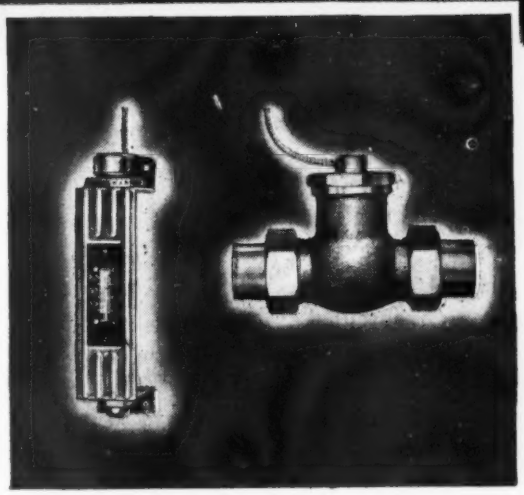
PACIFIC *Engineered* PUMPS

Controlled Summer Comfort for the cold winter coming!

"A guy can't work if his hands are cold . . . and he doesn't feel right."

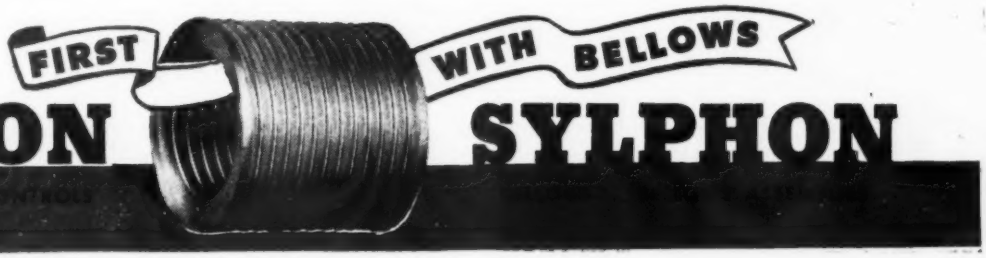
The best answer to this production axiom, a common everyday problem in many plants and establishments, is controlled temperatures. No. 7 Series of Fulton Sylphon Regulators control steam supply to unit heaters, wall or ceiling type radiators, duct heaters and other types.

Installation is simple. Controls, themselves, are self-powered. Therefore, they do not depend upon auxiliary power, which may, through failure, cause losses in time and materials. For complete information, write for Bulletin TS-820 today . . . The Fulton Sylphon Co., Knoxville 4, Tennessee. Canadian representatives, Darling Brothers, Montreal.



No. 7 Temperature Regulator

Sturdy, dependable, easily operated, highly efficient modulating type of control. Designed and built for long use. Backed by more than 40 years of experience in the production of precision instruments.



makes tough piping jobs easy!

Architects . . . designers . . . contractors . . . builders, searching for a corrosion-resistant, vibration-proof method of joining copper or brass pipe in cramped quarters or where space-saving is important, will find the answer in Silbraz* joints – made with Flaggseal Fittings.

Flaggseal Fittings are not connected by threading. They can be installed exactly where needed. No space is required for wrench tightening, or for lining up pipe and fitting. No crossed threading is possible . . . and the pipe surface remains unmarred by the use of the pipe wrench.

What's the secret? The answer is simple! A silver alloy is incorporated in each bore of the fitting. This alloy, when heated with the oxyacetylene torch becomes free flowing at 1300°F. and penetrates the lap area between the pipe and fitting, making a joint that is leakproof and permanent – a joint that will withstand severest vibration and have bursting pressures greater than those of standard weight copper or brass pipe.

Flaggseal Fittings are particularly suited to hot and cold water circulating systems, boiler feed lines, steam return lines, condensate lines, low and high pressure air piping systems, and many other applications in hospitals, schools, apartments, commercial, public and industrial buildings, as well as numerous marine installations. For full details, write: Stanley G. Flagg & Company, Inc., 1421 Chestnut St., Philadelphia 2, Pa.

*Patented—Reg. U. S. Pat. Off.

FF

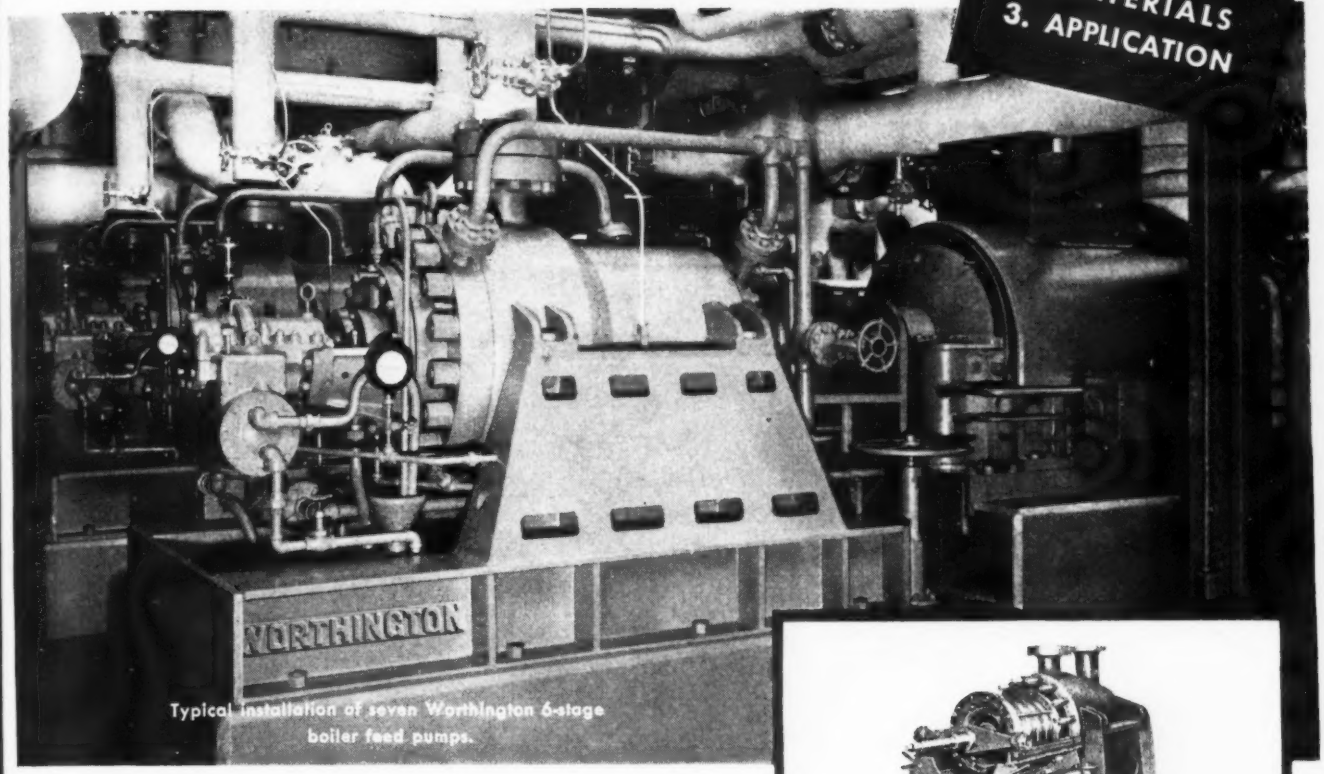
FLAGG FITTINGS

SINCE 1854

MALLEABLE IRON FITTINGS • CAST IRON SCREWED FITTINGS • DRAINAGE FITTINGS
FLANGE UNIONS • FLANGES • GROUND JOINT UNIONS • RED BRONZE FITTINGS
FLAGGSEAL BRONZE FITTINGS • SPECIALTIES AND CASTINGS

WHY WORTHINGTON HIGH-PRESSURE PUMPS *excel in all three . . .*

1. DESIGN
2. MATERIALS
3. APPLICATION



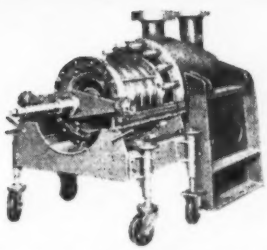
Typical installation of seven Worthington 6-stage boiler feed pumps.

1. DESIGN —Worthington has longer experience in manufacturing high-pressure centrifugal boiler feed pumps . . . has acquired unique constructive ideas from power-plant operating engineers. That's why you'll find such superior design features in Worthington high pressure boiler feed pumps as: a balancing device construction that minimizes wear; bolted ring-type pressure joints; impellers shrunk on the shaft; oversized Kingsbury thrust bearings.

2. MATERIALS —Worthington has greater facilities for research. That's why you'll find the *right* materials in Worthington high-pressure boiler feed pumps: stainless steel for internal parts—to prevent destructive corrosion and erosion; forged steel casings—tested and proved by years of power plant operation.

3. APPLICATION —Worthington Pump Application Engineers are thoroughly versed in every phase of applying the most complete line of boiler feed pumps for high or low pressures — capacities from 50 to 3500 GPM . . . pressures from 50 to 2500 PSI. That's why Worthington will fit the *right* feed pumps to your feed cycle.

For further details on Worthington High-Pressure Boiler Feed Pumps . . . or for an appointment with a Worthington P.A.E.*, write us or telephone the nearest of our 36 district offices. You'll find



AS EASY TO DISMANTLE AND ASSEMBLE AS A SPLIT-CASE PUMP

Complete rotor assembly of Worthington High-Pressure Boiler Feed Pump can be withdrawn *in one piece* on a portable assembly truck without disturbing suction or discharge piping connections. Simplifies inspection, replacement or repair of internal parts.

that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

*Pump Application Engineer

WORTHINGTON

24C5-3

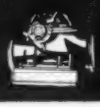
THE WORLD'S LARGEST MANUFACTURER OF PUMPS

For Boiler Feed Service
Capacities from 30 to 1500 g. p. m. Heads from 180 to 1000 feet.

For Hotwell, Condensate, Chilled Water, General Service
Capacities from 150 to 1300 g. p. m. Heads from 110 to 500 feet.

For Boiler Feed Service
Capacities from 25 to 1450 g. p. m. Heads from 220 to 1600 feet.

For Water Works, Circulation, Drainage, General Service
Capacities from 500 to 1600 g. p. m. Heads 900 to 3200 feet.



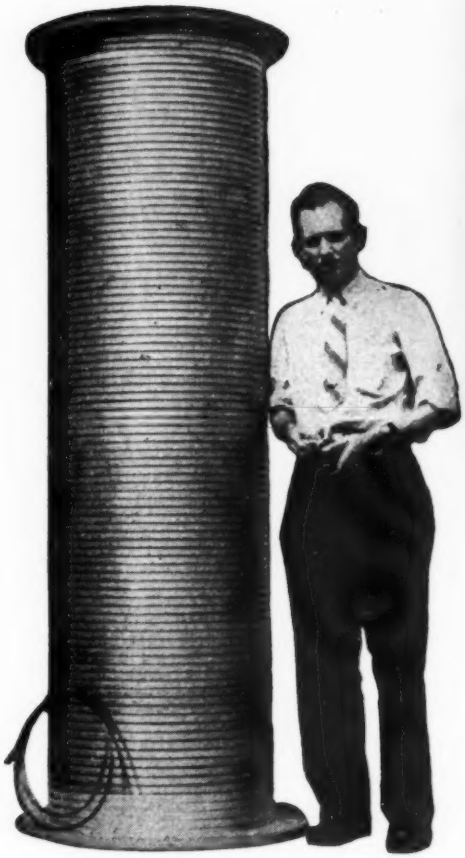
For Boiler Feed Service
Capacities from 200 to 1600 g. p. m. Heads from 900 to 3200 feet.

For Boiler Feed Service
Capacities from 500 to 3000 g. p. m. Heads from 2000 to 7000 feet.

PENFLEX

NOW 24" I.D. PENFLEXIBLE INTERLOCKED GALVANIZED STEEL HOSE FOR STATIONARY and MARINE DIESEL EXHAUSTS

PENFLEX Interlocked construction resists pulsations of load and pressure, absorbs vibration, prevents metal fatigue. PENFLEX Interlocked construction provides the flexibility to make quick, easy installations. PENFLEX Interlocked construction with asbestos packing gives you a pressure-tight, trouble-free exhaust connection. PENFLEX 24" Interlocked, the largest hose in the PENFLEX line, has a bending radius of approximately seven times its diameter and a working pressure of 15 to 25 psi. PENFLEX Interlocked construction requires no special tools or heat to bend.



Complete range of sizes from 5/32" I.D. to 24" I.D.

PENFLEX
Hose and Tubing is also available for other flexible connections on Diesel Installations.

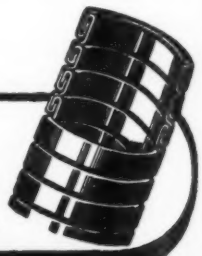
PENFLEXWELD
for Fuel Oil and Starting Air.

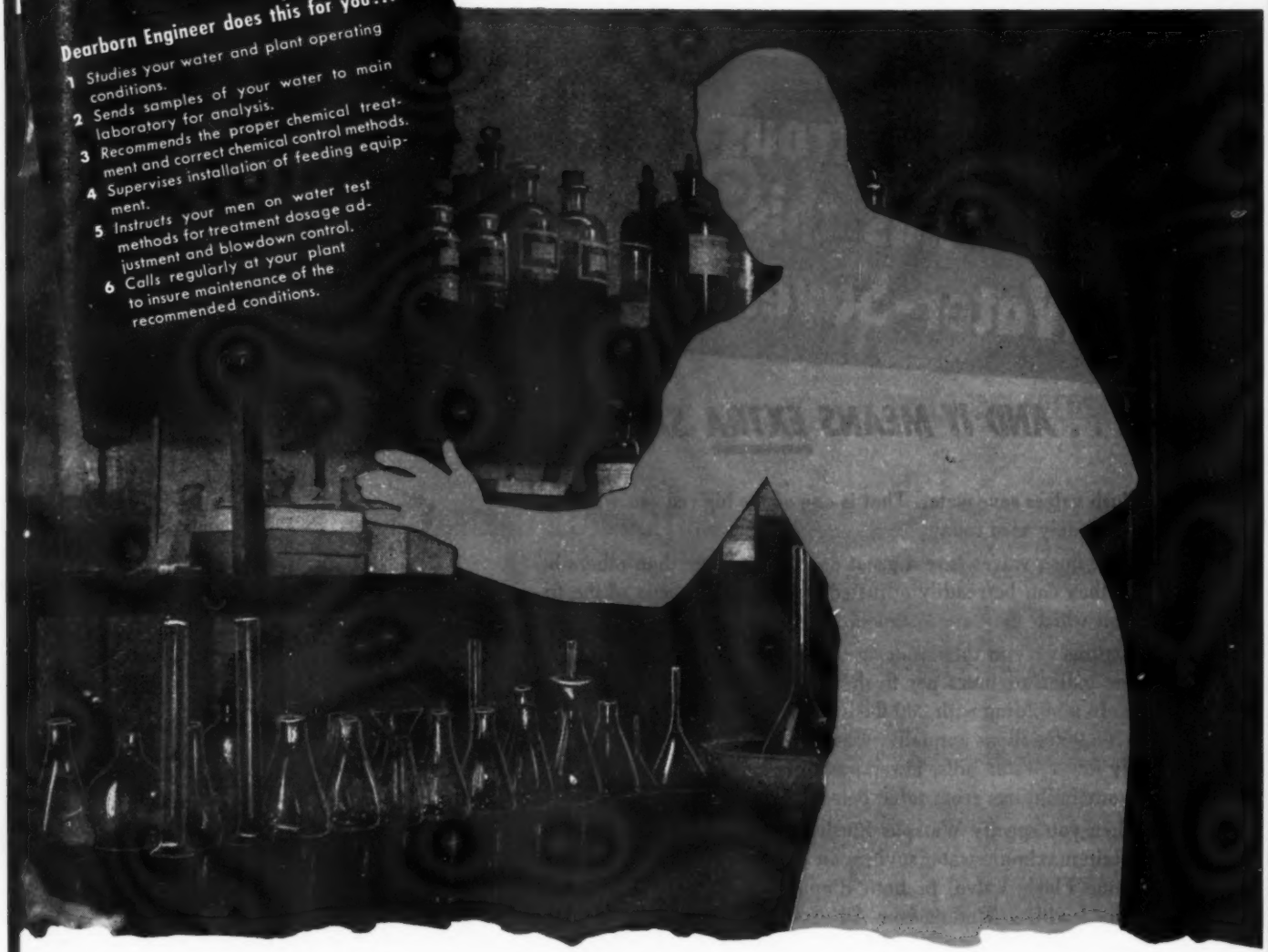
PENFLEX
Interlocked for Lubricating Oil, Circulating Water, Exhausts and Air Intake Lines. Write for Bulletin 71.

PENFLEX METAL HOSE

PENFLEX

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7238 POWERS LANE **PHILADELPHIA 42, PA.**
Established 1902




Dearborn Engineer does this for you...
1 Studies your water and plant operating conditions.
2 Sends samples of your water to main laboratory for analysis.
3 Recommends the proper chemical treatment and correct chemical control methods.
4 Supervises installation of feeding equipment.
5 Instructs your men on water test methods for treatment dosage adjustment and blowdown control.
6 Calls regularly at your plant to insure maintenance of the recommended conditions.

DEARBORN ENGINEER Starts his work

RIGHT IN YOUR BOILER ROOM

The Dearborn Engineer goes into your boiler room with the experience and background of a boiler water expert. He lives in your district; knows local water characteristics. An on-the-spot analysis of water samples and study of plant conditions enable him to quickly detect the causes of scale, foaming, corrosion, or other troublesome conditions traceable to water. Samples together with his report are sent on to the Dearborn Master Laboratories. While he establishes temporary corrective measures, the Dearborn laboratories double-check his findings and prepare the proper chemical treatment formula. The result is that the treatment and control methods which he finally recommends assure boilers of full steaming capacity and continuous operation. He is as near as your telephone. Call him . . . he'll be glad to help you.

DEARBORN CHEMICAL COMPANY, Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.

Dearborn

TRADE MARK REGISTERED

THE LEADER FOR OVER 25 YEARS

ENGINEERING SERVICE AND WATER TREATMENT

Every Watrous Flush Valve has this simple Water-Saver Adjustment

. . . AND IT MEANS EXTRA SAVINGS TO WATROUS OWNERS

Flush valves save water. That is one of the big reasons why they are so widely used today.

Some flush valves save a great deal more water than others because they can be readily adjusted to the actual needs of the fixture on which they are installed.

Fixtures vary in their water requirements—frequently as much as one gallon or more per flush can be saved by proper adjustment. In a building with 200 flush valves this saving could amount to 1,168,000 gallons annually. Water savings like this mean appreciably lower water bills, lower pumping costs. Judge the savings for your buildings from table below.

When you specify Watrous Flush Valves, you make it possible to obtain maximum water savings on *every* fixture—because every Watrous Flush Valve, in both diaphragm and piston types, is equipped with a Water-Saver Adjustment.

This simple screw driver adjustment requires only a few seconds—there is no need to take the valve apart, or even shut off the water. It assures greater water savings to Watrous owners, and is one of the reasons why the selection of Watrous Flush Valves is a source of constant satisfaction over the years to everyone concerned.

Estimated annual savings of water obtainable through proper regulation of flush valve to actual water needs of the fixture

	Building with 100 Flush Valves	Building with 500 Flush Valves	Project with 1000 Flush Valves
When average of ½ gal. saved per flush	292,000 gallons	1,460,000 gallons	2,920,000 gallons
When average of 1 gal. saved per flush	584,000 gallons	2,920,000 gallons	5,840,000 gallons

THE IMPERIAL BRASS MANUFACTURING COMPANY
514 S. Racine Ave., Chicago 7, Illinois

. . . another Watrous point of superiority

• Watrous Majestic Flush Valve being adjusted. Simply unscrew cap nut and turn adjusting screw to increase or decrease length of flush.

For complete information on Watrous Flush Valves, write for Catalog No. 448-A. Also ask for Bulletin No. 477 giving a summary of "Architects' Views on Flush Valve Applications."

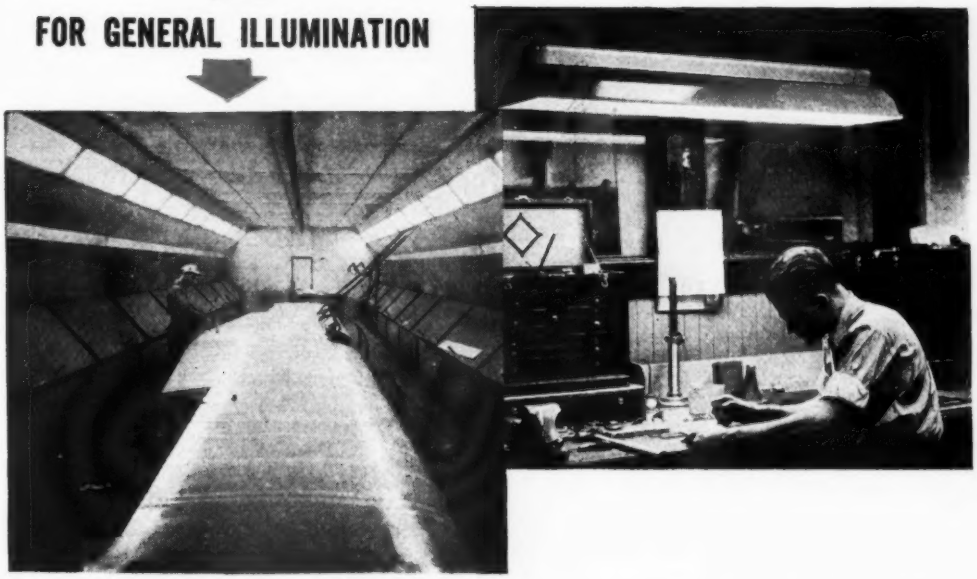
Watrous Flush Valves

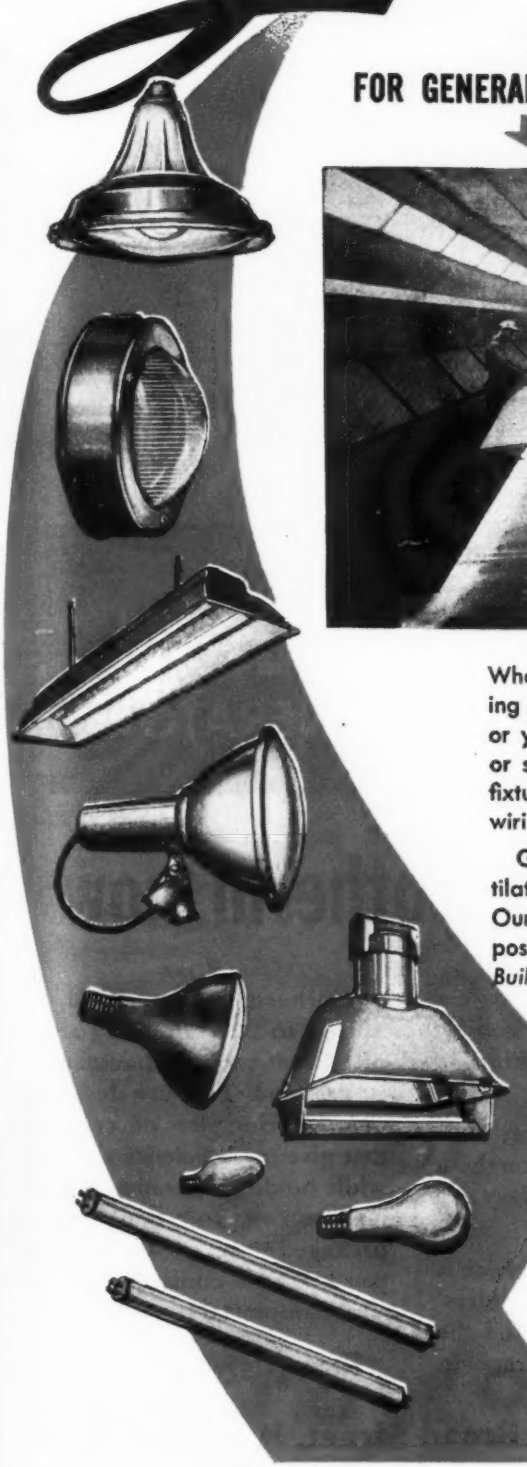
THEY PAY FOR THEMSELVES IN THE WATER THEY SAVE

Light

FOR LOCAL AREAS

FOR GENERAL ILLUMINATION





Whether your lighting problem is one of raising illumination level, of avoiding glare or ending shadows — a Graybar Lighting Specialist can help you or your electrical contractor solve it. For general illumination, or for local or supplemental lighting, Graybar can supply suitable indoor or outdoor fixtures (incandescent, fluorescent, or mercury), matching G-E Mazda lamps, wiring, transformers, and ballasts.

Graybar also distributes motors, cable, communication systems, ventilating apparatus, welding equipment, and many other electrical needs. Our nationwide network of warehouses offers you the fastest deliveries possible under today's conditions. *Graybar Electric Company, Graybar Building, New York 17, N. Y.* 4558

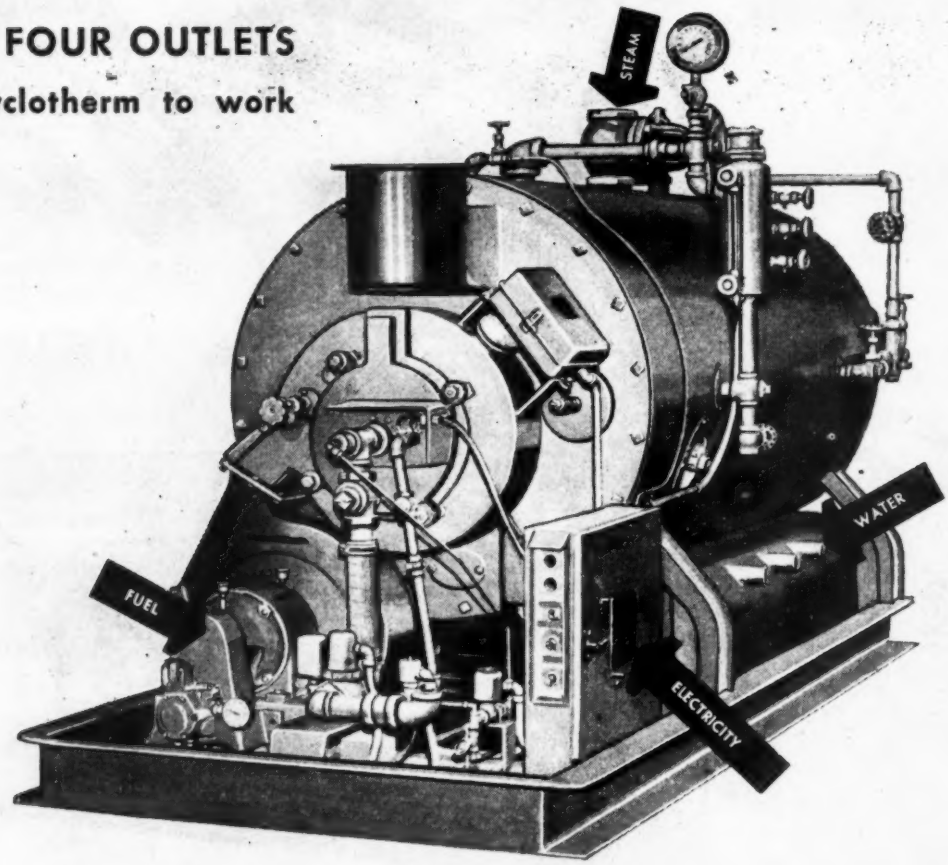
IN OVER 80 PRINCIPAL CITIES

Via GraybaR

...the Double-Duty Source of Supply

CONNECT FOUR OUTLETS

Now put Cyclotherm to work



60 HP Combination Burner for Gas-Oil Cyclotherm Unit

CYCLOTHERM STEAM GENERATOR

Order your post-war Cyclotherm now

Cyclotherm Steam Generators are available to industry on a peacetime basis, *without priority for immediate delivery.*

With fuel restrictions lifted, you will want to modernize your power plant with a Cyclotherm Steam Generator.

Whatever your use of steam, the immediate answer is a completely assembled, packaged Cyclotherm unit.

Cyclotherm is emerging from the war with a veteran's reputation for delivering results under all kinds of service conditions.

Thousands of Cyclotherm units have been in service throughout the world with the Army, Navy and Marine Corps.

Cyclotherm's record of service is your best guarantee of its builders' engineering "know-how" and the quality built into a Cyclotherm unit.

Cyclotherm units range from 10 HP to 200 HP. They are completely self-contained, automatic, oil or gas fired. They are designed on unique principles of combustion that give top efficiency and service while holding operating and maintenance costs to a minimum. This packaged steam generator will give you years of continuous, trouble-free, economical service.

Orders are being filled promptly.

CYCLOTHERM CORPORATION · Box 102 · 90 Broad Street, New York 4, N. Y.

INSTALLED FOR AN 8 HOUR DAY . . .

This installation consists of two 24" conveyor belts, each 835 ft. long, running side by side on an incline. They are operating at one of the largest power producing plants in the Middle West. The installation was originally designed for an eight-hour day. Now, on account of the requirements of the war effort, the belts are being operated sixteen hours daily . . . and furthermore, the installation has been stepped up in belt speed about one-third.

All BWH conveyor belts are engineered and built to conform to certain definite conditions of speed, load and abrasion. Nevertheless, there is always present in BWH belts sufficient quality, stamina and inherent strength to pinch-hit on harder work if conditions demand, as is abundantly proven in this instance.

BOSTON WOVEN HOSE & RUBBER CO.

WORKS: CAMBRIDGE, MASS., U.S.A.
P.O. BOX 1071, BOSTON, MASS., U.S.A.

BOSTON WOVEN HOSE TRADE MARK AND RUBBER COMPANY

PLAN TODAY...
TO MOVE COAL THE G-W WAY

Suppose your coal-handling problem is to install a conveyor-elevator system for storage and distribution of coal to bunkers, and from there to stokers or pulverizers. One way it could be solved is graphically illustrated by this composite photo and diagram. The installation shown comprises *standard* G-W equipment co-ordinated into a handling system meeting *specific* requirements—the moving of coal, mechanically, from car to live storage and reserve storage . . . thence to the boiler room. Or your problem may be to install the best type of conveyor to distribute coal evenly and with no segregation throughout the bunkers . . . or, where a number of boilers are served by a common bunker, to decide whether movable spouts or traveling weigh larries will deliver the coal with greatest efficiency and economy.

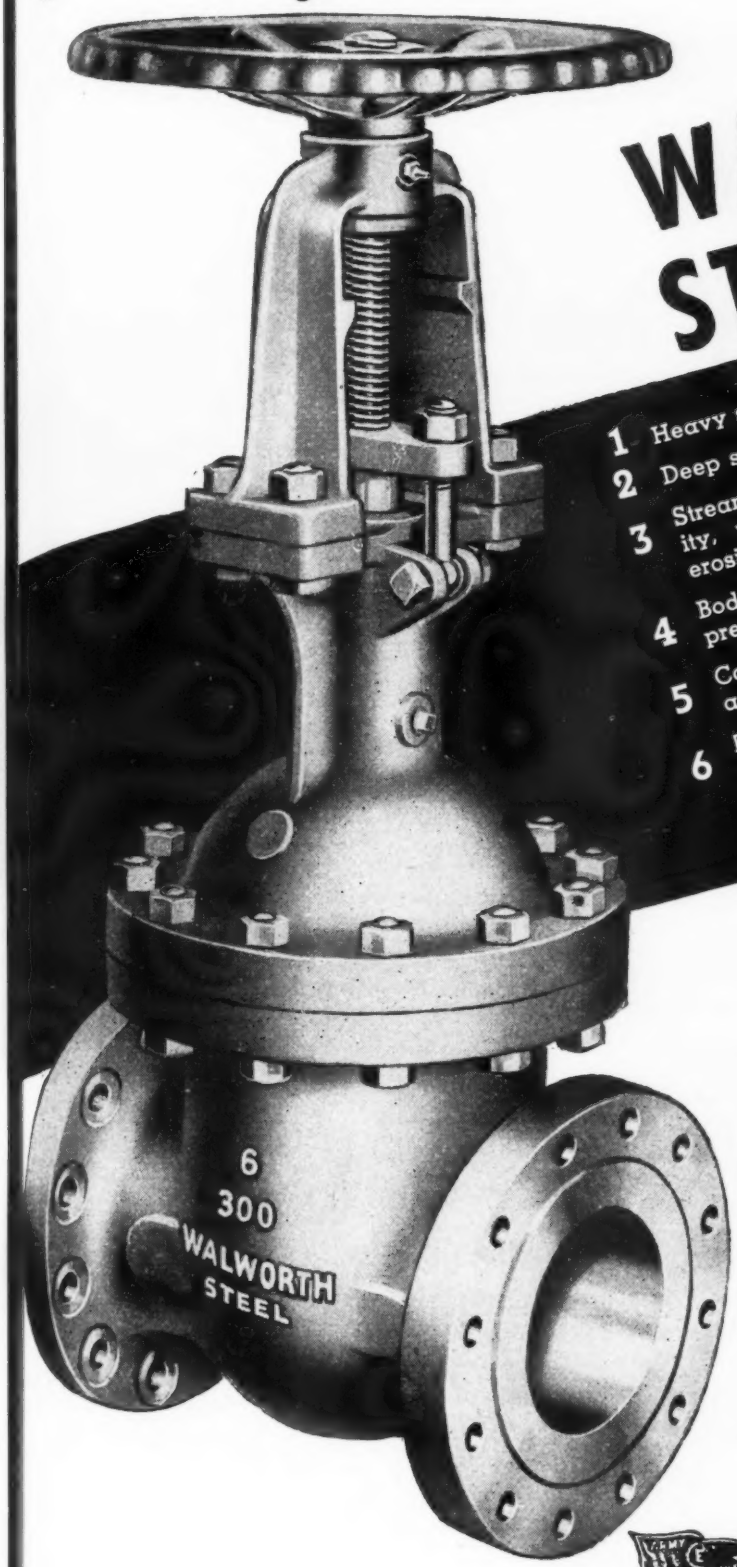
To these problems, and many others, G-W experts bring specialized experience as designers and builders of coal storage and coal and ash handling systems for over 130 years. In this time Gifford-Wood has not only developed efficient standard equipment but has acquired experience which particularly qualifies them to design, build and install special systems to meet unusual conditions. Gifford-Wood Co.,
420 Lexington Ave., New York 17, N. Y.;
565 W. Washington St., Chicago 6, Ill.
Factory—Hudson, N. Y.

DO YOU KNOW?—G-W is also *Handling Headquarters* for Industrial Conveying and Elevating Systems . . . for Ice Handling Tools and Ice Processing Equipment . . . for Infra-Red Baking and Drying Systems . . .

G-W HANDLES IT
Faster · Easier · Cheaper

GIFFORD-WOOD
SINCE 1814

You get all these BIG features in WALWORTH STEEL VALVES



1 Heavy steel walls for extra strength and protection.

2 Deep stuffing boxes to eliminate costly leaks.

3 Streamlined ports to make possible a high velocity, non-turbulent flow, and reduces possible erosion.

4 Bodies and bonnets engineered to withstand pressure and minimize distortion.

5 Cast body guide rib faces, machined to insure accurate disc centering.

6 Exact design, metallurgy and construction of yoke nuts, bonnet bushings, gland followers, handwheels and other vital parts to assure better service for a longer period of time.

Is there any wonder that out in the field, where approval is based on performance under actual operating conditions, industry has put its O.K. on Walworth Steel Valves?

Tough . . . wear resistant . . . dependable, these valves are produced in gate and globe types, in sizes to cover practically every service requirement. They are excellent examples of Walworth leadership . . . leadership that has made the Walworth valves famous throughout the world.

Walworth Catalog 42 gives complete information regarding Steel Valves as well as the full line of Walworth valves and fittings in bronze and iron. Your copy may be obtained upon request. Whenever you need valves — whether steel, bronze or iron — remember Walworth for dependability, economy, and long service life.

14 AWARDS TO 4 PLANTS

WALWORTH
valves and fittings
60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Oversize construction

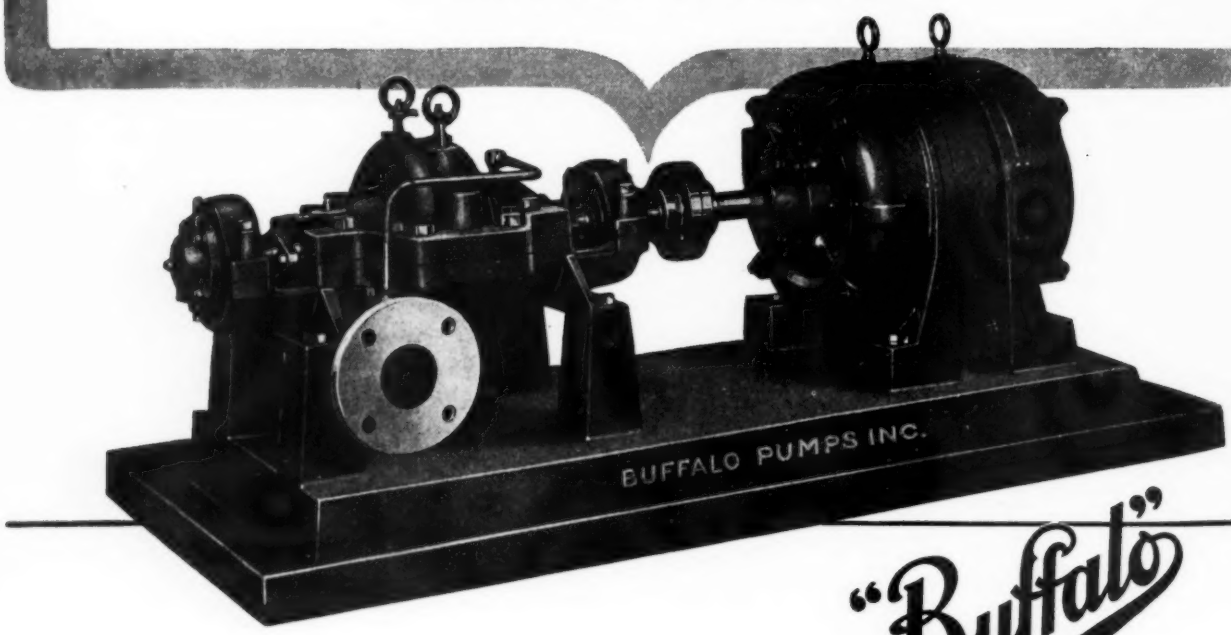
means lower maintenance costs

• The original specification for Buffalo "RR" Pumps called for a general service pump of "beyond the ordinary" reliability. Buffalo engineers determined to build a high efficiency pump with such a margin of over-load capacity that there would be no question of its ability to stand up under hard service. The Type RR Pump is the result; an efficient, two or four stage single suction pump with impellers, mounted back to back to provide perfect hydraulic balance. All parts of the pump are oversize construction — bearings, shaft, glands, even the casing—so that these pumps keep running on the jobs where the going is tough. Get full details on these pumps from Bulletin 980A, sent on request.

BUFFALO PUMPS INC.

488 Broadway **Buffalo, New York**

Canada Pumps, Ltd., Kitchener, Ont.



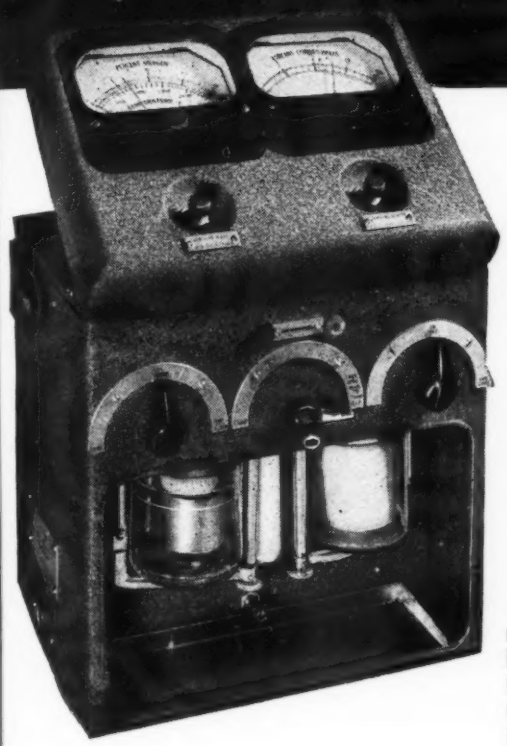
"Buffalo"

TYPE RR

CENTRIFUGAL PUMPS

How efficiently are you Burning Fuel?

YOU CAN FIND OUT—IN JUST A FEW MINUTES—WITH THE CITIES SERVICE INDUSTRIAL HEAT PROVER



This unique instrument indicates simultaneously the percentage of unburned fuel, or oxygen present in the flue gases.

With this data the Cities Service engineer can show you at once how to *save* on fuel costs.

The Industrial Heat Prover has been applied with uniformly successful results to every kind of fuel and to every type of combustion equipment in this country.

Also used successfully for controlling furnace atmospheres in the heat treatment of steel.

For a demonstration of the Industrial Heat Prover on your own equipment, contact your nearest Cities Service office or mail the coupon below.

MAIL THIS COUPON TODAY

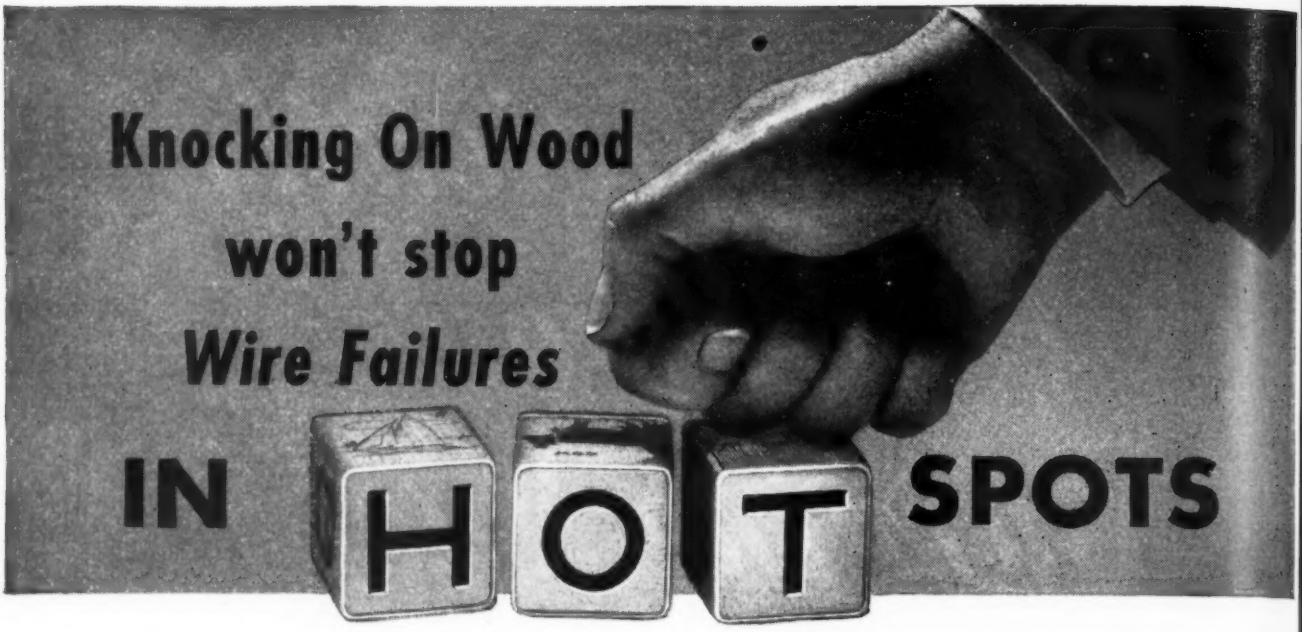
(Available only in Cities Service Marketing Territories East of the Rockies)

Cities Service Oil Co.
Room 443, 70 Pine Street
New York 5, N. Y.

Gentlemen: Please send me further information on the Cities Service Industrial Heat Prover—at no obligation to me.

Name .....
Title .....
Company .....
Address .....
City ..... State .....

CITIES SERVICE OILS
ONCE-ALWAYS

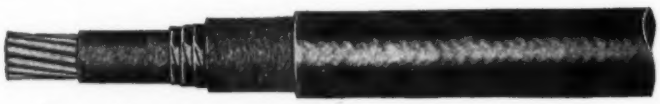


Continuous operation, copper-heating overloads, high ambient temperatures, oil, grease and corrosive fumes have been rough on emergency power, control and lighting wiring that wasn't built to stand up long under such conditions . . . so don't trust to luck and be sorry later.

Check up right now on war-worn circuits that run too close to steam lines, furnaces, forging presses, annealers, kilns, soaking pits . . . or anywhere that heat and other severe conditions may cause trouble . . . and rewire with Rockbestos A.V.C. *permanently insulated* wires and cables. They save money by practically eliminating maintenance because they are built to take 230° F. without baking brittle, cracking, flowing or de-centering . . . and won't rot or bloom from contact with oil, grease or corrosive fumes.

For detailed information on Rockbestos-designed National Electrical Code types in our line of 125 different standard constructions, write to the nearest branch office or:

ROCKBESTOS PRODUCTS CORPORATION, 107 NICOLL ST., NEW HAVEN 4, CONN.



1 2 3 4 5

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE (National Electrical Code, Type AVA)

The cable above and similarly insulated Motor Lead Cable have a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1. The conductor is perfectly and permanently centered in helically applied insulation.
2. Felted asbestos insulation, impregnated with heat, flame and moisture resisting compounds, withstands conductor-heating overloads and won't dry out, bake brittle, flow or burn.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Outer felted asbestos wall, impregnated with heat, flame, and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.
5. A tough rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

125 different wires, cables and cords developed for severe operating conditions by Rockbestos.

INVEST IN U. S. VICTORY BONDS

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(Nat. Elec. Code Type AVA—max. operating temp. 110°C.)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of impregnated asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.

ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

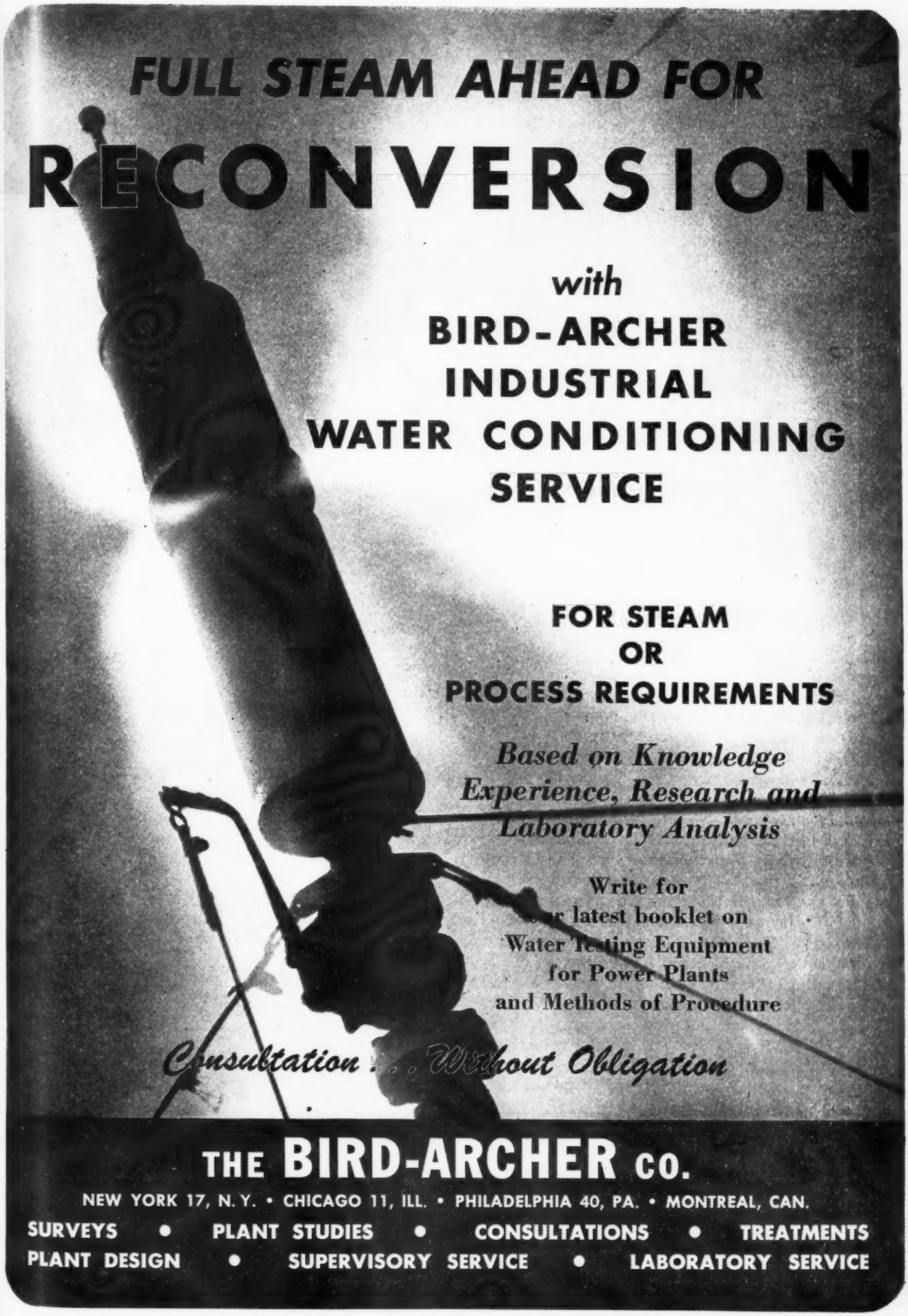
In one to 19 conductors with individuals insulated like Power Cable, cotton braid covered, and cabled with an asbestos braid overall. Standard strandings AWG No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

Designed for use in equipment requiring a multi-conductor control cable capable of withstanding high temperatures, this cable is widely used in the control systems of electric cranes and other equipment used in steel mills. The insulation is unaffected by heat, corrosive fumes, oil or grease and has ample moisture resistance.

★ ★ ★ ★ ★

ANOTHER NEW ROCKBESTOS FIREWALL CONSTRUCTION!

War-developed Rockbestos High-Temperature Wire — *with a maximum operating temperature of 400° F.* — designed for jet propelled plane applications and circuits to hot-wing de-icers, fire detectors and extinguishers, and air conditioning and heating units where baking temperatures destroy ordinary insulation. Under continuous operation at rated temperature it retains its original dielectric strength and inherent resistance to heat and flame, and *progressively improves* in its resistance to moisture and abrasion. It is now available for these and other severe applications. Write for complete information and samples.



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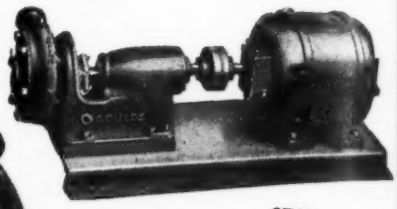

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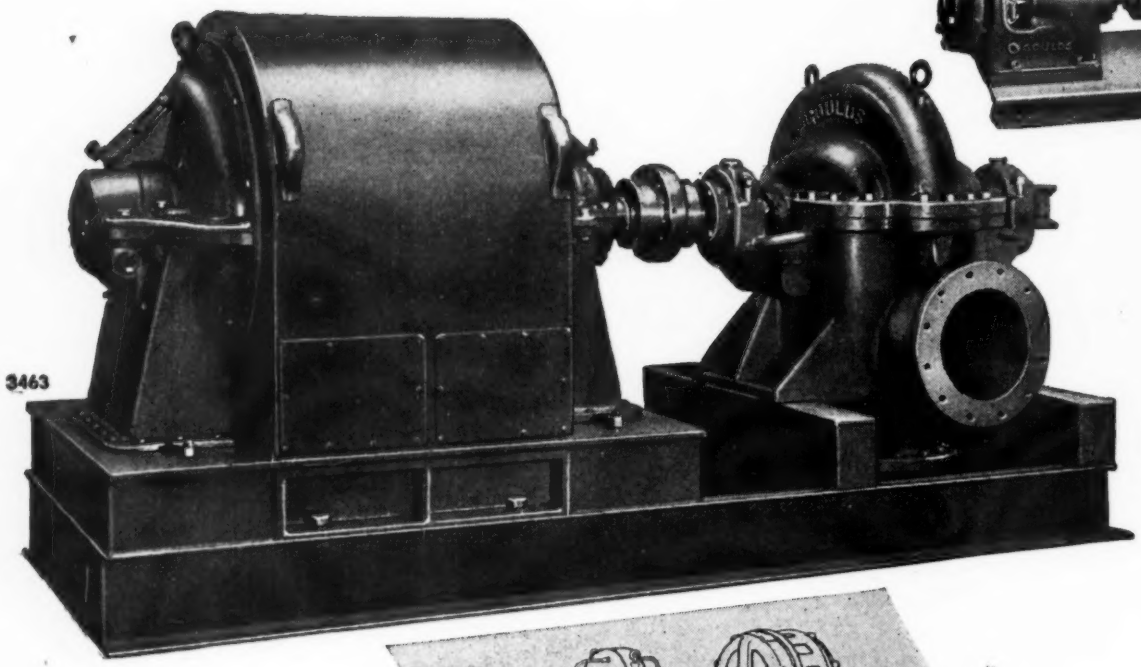

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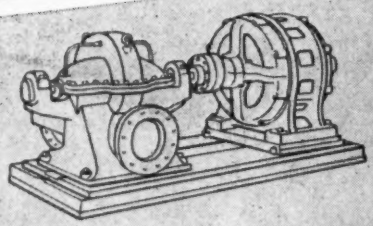

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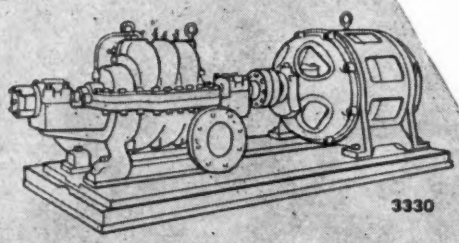

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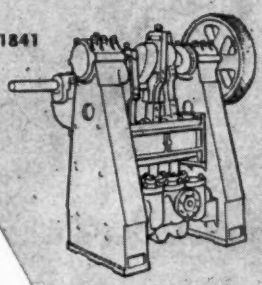

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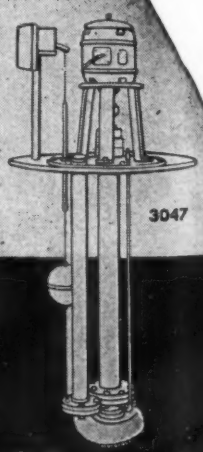


3047

You can't use the same pump to deliver 15,000 gallons per minute that you would use to deliver 10 gallons per minute. But from the Goulds complete line you can get the pump to meet your requirements in capacities anywhere between that wide range. And the pump that will lift against a head of 10 feet can certainly not be used where pressure heads are 3200 feet. But here again in the Goulds complete line will be found the pump for that duty.

Boiler feed service may be one requirement, another may be sump service, or any other of the many duties in a power plant. No matter what the service, there is a Goulds Pump to meet that requirement.

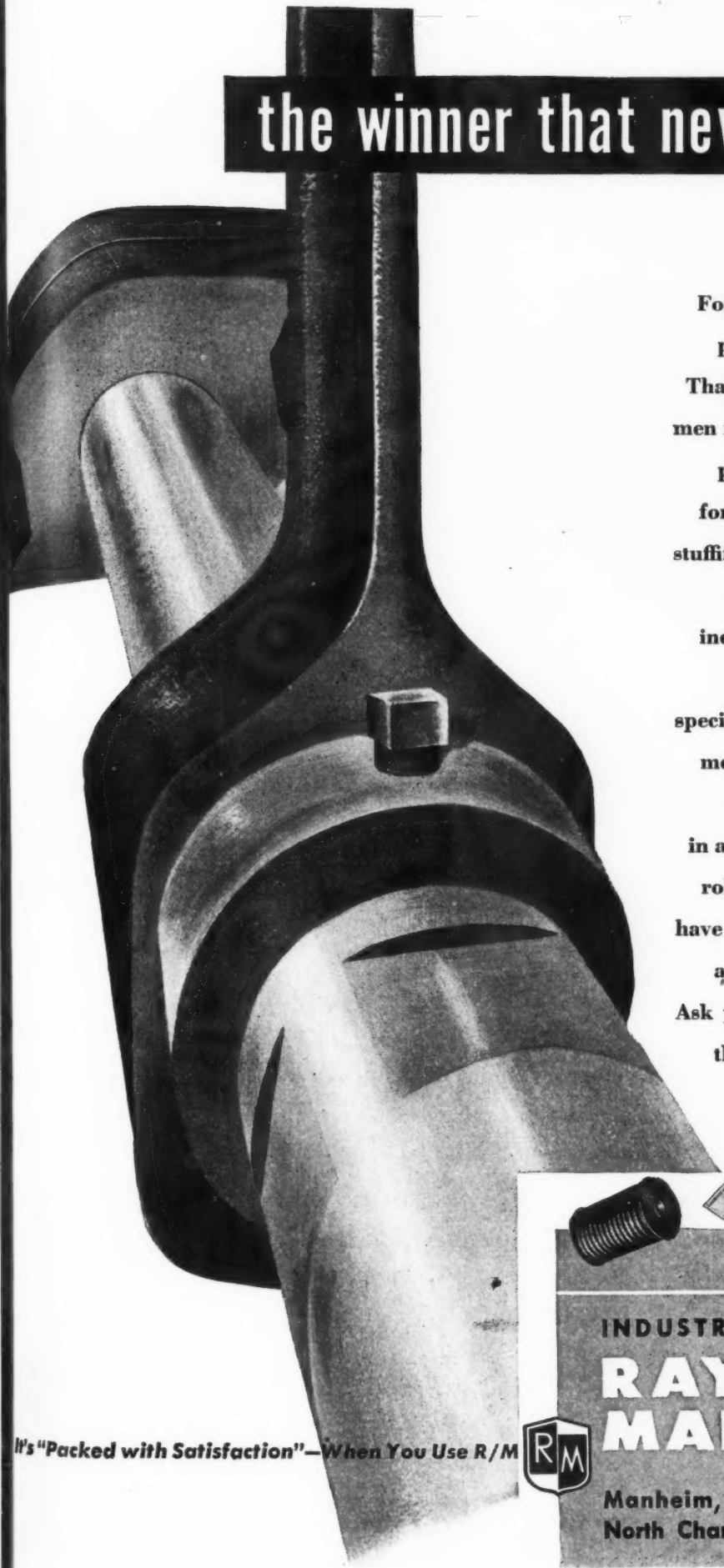
Goulds 96 years in pump building experience covers practically every branch of American Industry where liquids and semi-solids are handled. Because Goulds builds centrifugal, rotary and reciprocating pumps in a wide range of sizes and in various materials of construction depending upon the service, Goulds engineers can give you *the* Pump for *the* job. Consult Goulds on your reconversion requirements.

GOULDS PUMPS, INC.
SENECA FALLS, NEW YORK

Goulds

the PUMP FOR the JOB

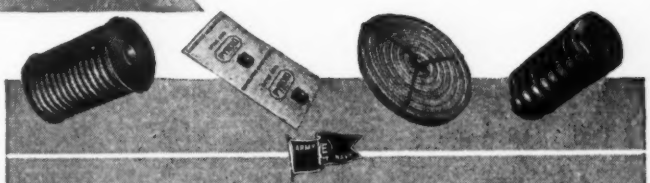
the winner that never scores



For reciprocating-rods, the winning packing is the one that never scores. That's why experienced maintenance-men for more than forty years have been picking non-scoring R/M packings for trouble-free service on pumps and stuffing-boxes.

For thousands of other kinds of industrial equipment, R/M packings are doing a winning job. Made of specially chosen materials, designed to meet the particular needs of different types of service, they are available in a complete range of sizes, and in coil, roll, spiral, bulk, and flat form. If you have special packing needs, we will make any shape you require.

Ask your distributor for the catalog on the complete R/M line.



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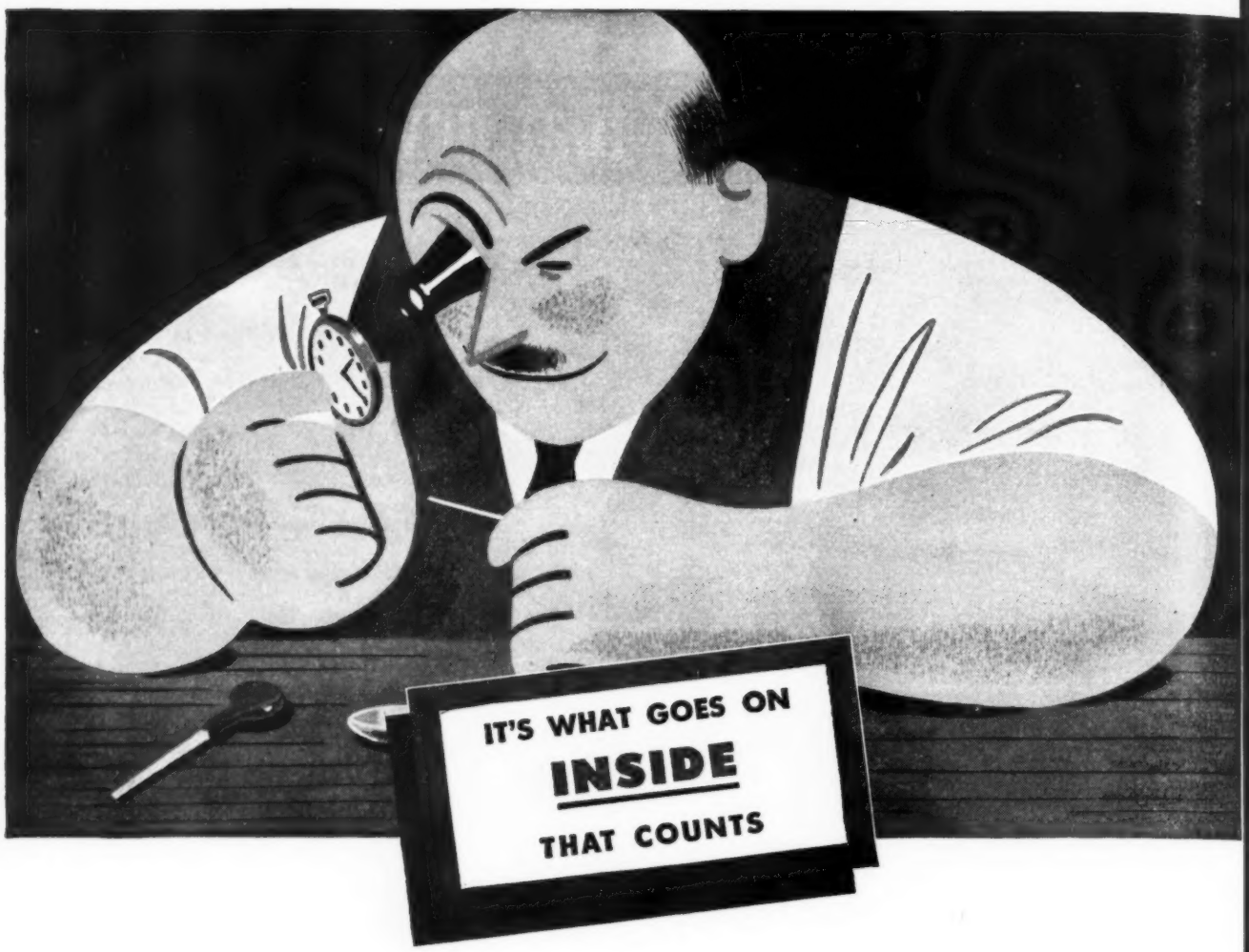

Inside an engine, Pedrick rings make things go like clockwork

MORE POWER, more pep, more hours on the job . . . that's the report we've been hearing from users of Pedrick rings for twenty-five years. Once Pedrick rings are in, it's a long, long time before you need to recondition again.

And Pedrick rings make engine-repair jobs go like clockwork, too. Technical literature, service manuals, field men, special bulletins are a part of Pedrick service that leaves nothing undone to help make ring jobs easy and accurate. Even "green" help find Pedrick rings easy to install right.

The day of plenty of new Diesels is still months away. To get extra hours of efficient service from your present equipment, to hold down shop and operating costs, recondition with Pedrick *precisioneered* piston rings. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

The Emblem of Honorable Discharge from the United States Armed Services

Pedrick
precisioneered PISTON RINGS

Teeter-totter
STEAM LOADS

FLUCTUATING or intermittent steam loads are no problem when you have custom-planned Cleaver-Brooks steam generators in your boiler room. Whether the demand is heavy or light, steady or variable, these sturdy, compact steam generators respond instantly and operate with a flat efficiency of 80% at low or high steaming rates. Consider all these additional advantages of a Cleaver-Brooks installation:

- A steam plant tailored for your job. Cleaver-Brooks analyzes your load conditions, space and equipment arrangements, future growth needs, puts unit into initial operation, instructs as to operation, care and maintenance.
- Designed for utmost convenience of operator — all controls may be operated from front of boiler. A factory engineer puts unit into initial operation, and trains your employees in operation, care and maintenance.
- One source and one responsibility for the complete generator — Cleaver-Brooks Factory-finished and tested — a fully "packaged" unit meeting all code requirements.
- Fast installation. No special foundation needed. Within 24 hours after arrival, your Cleaver-Brooks Steam Generator can be in operation.
- No smoke-stack required; simple roof-high vent exhausts combustion gases.
- Saves space, uses less plant area, fits into low head-room locations.
- Oil-firing eliminates smoke, ashes, clinkers, messy-boiler-room conditions.
- Low operating costs; unsurpassed guarantee: — 80% thermal efficiency; 13% CO_2 gases; stack temperature not to exceed 125° F. above saturated steam temperature.
- Quick steaming — for any emergency or fluctuating loads — through high heat transfer with Cleaver-Brooks 4-pass down-draft construction and integral oil-burner.
- Full size range is available — 22 models in sizes from 15 to 500 h.p., at steam pressures from 15 to 200 lbs. p.s.i. Write for bulletin and complete information.

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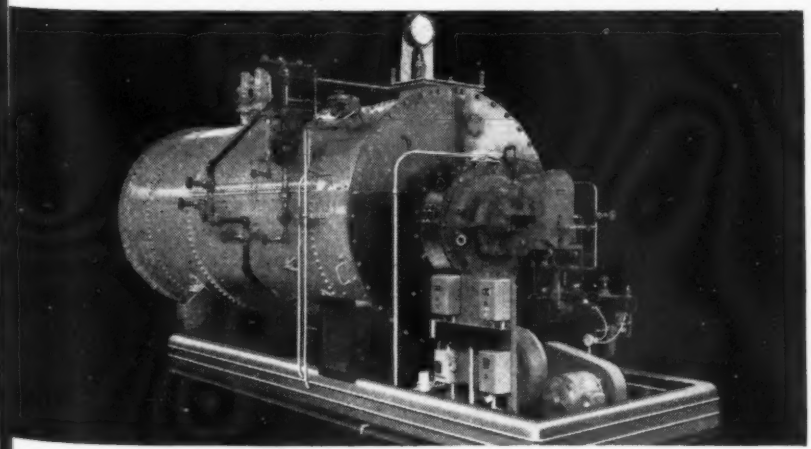

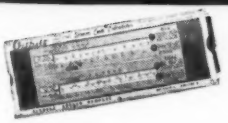

WRITE ON YOUR BUSINESS LETTERHEAD
for the Free Steam Cost-Calculator—a ready-reference sliderule showing the comparative steam costs when using oil or coal as fuel.

Cleaver-Brooks
STEAM GENERATORS

7 ways to use LUMNITE in power plants

Operators and builders of steam power plants reduce outages and maintenance costs by using corrosion-resistant and heat-resistant concretes and mortars made with this special cement.

1. **Ash Pit and Cinder Catcher Linings**—Heat-Resistant LUMNITE concrete withstands wear and corrosion in both wet-type and dry-type units.
2. **Coal Bunker Linings**—LUMNITE concrete resists abrasion and corrosion.
3. **Flue and Duct Linings**—LUMNITE concrete resists abrasion of flue gases and fly ash, provides insulation where required.
4. **For Steel Stacks**—Jointless LUMNITE linings, generally applied with a cement gun, protect steel stacks from corrosion; their insulating properties improve efficiency.
5. **For Brick Chimneys and Linings**—LUMNITE mortar resists attack of sulphur compounds from stack gases; especially good when operating intermittently or at low temperatures.
6. **Castable Refractories, made with LUMNITE**—used for jointless walls and arches, baffles, burner blocks, door linings, stoker settings and general refractory purposes.
7. **Overnight Structural Concrete**—For rapid maintenance, LUMNITE provides full-strength concrete in 24 hours or less, even in freezing weather.

√ √ √

WHAT IS LUMNITE?

LUMNITE is a special hydraulic cement for special purposes. It is of the calcium-aluminate type and is not a portland cement. It is essentially a structural cement used with special aggregates to make concrete having corrosion-resistant and heat-resistant properties, and for rapid-hardening structural concrete.

LUMNITE is packed in multi-wall, moisture-proof paper bags and may be stocked like portland cement. For convenient volume measurement, one cubic foot of LUMNITE is packed in each bag.

LUMNITE AVAILABLE NOW

LUMNITE can now be purchased without restrictions or priorities. It may be obtained from building supply dealers throughout the United States and in Canada.

Send for the names of dealers near you and for detailed information on specific uses of LUMNITE in power plants. Also ask for reprint of article **"Deterioration and Maintenance of Power Plant Structures."**

THE ATLAS LUMNITE CEMENT COMPANY

(United States Steel Corporation Subsidiary)

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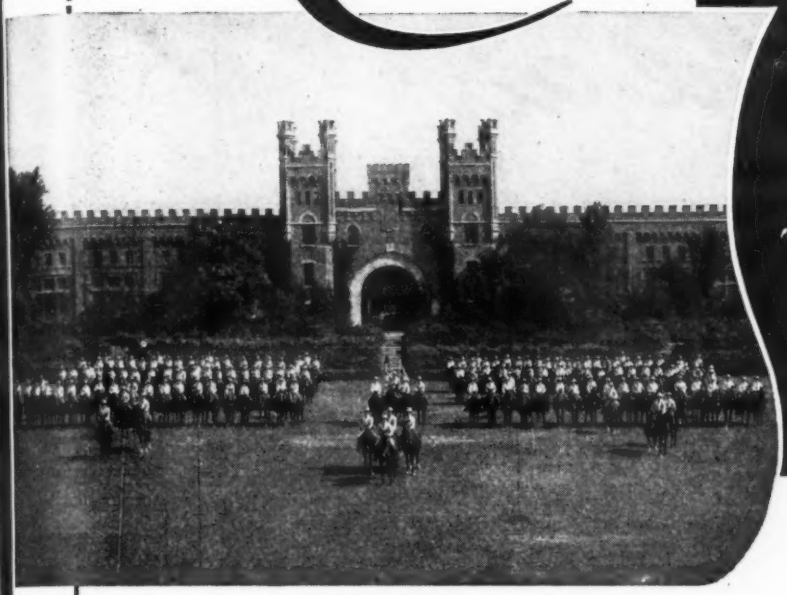
AT CULVER

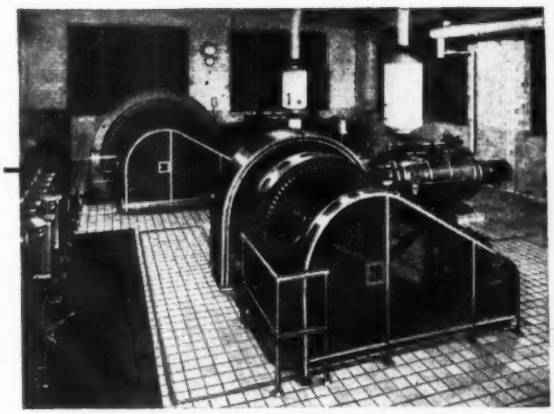


WHERE YOUTH ARE FORGED INTO MEN

"Fit for the citizenship of the morrow"

SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

Generate dependable, economical Electric Power . . .



The two horizontal "Universal Unaflow" Engines, with 312-kv.a. and 500-kv.a. Generators, in the Culver power plant

CULVER'S foundations were laid by men of courage, sincerity and vision. Founded in 1894 by Henry Harrison Culver, it has grown to be one of the great schools of America. Its grounds comprise 1000 acres on the shores of beautiful Lake Maxinkuckee in northern Indiana. Culver's students are trained in character, physical stamina and courage for positions of leadership in public and private life.

Two Skinner "Universal Unaflow" Steam Engines are a definite part of this great institution. They, too, have the stamina and the ability to stay on the job, whether the assignment is easy or tough; to offer no complaint when extra demands are made, and to generate dependable, economical electric power, with exhaust steam available for heating the twenty-three buildings.

The leadership of Skinner Engine Company and the "Universal Unaflow" in the steam engine field is generally recognized by power users, as evidenced by the many industries and institutions of various types in which they are installed.

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For Over 75 Years Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

Controls the air

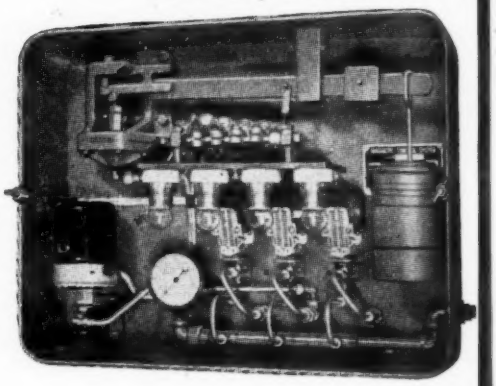
...TO FIT YOUR NEEDS!

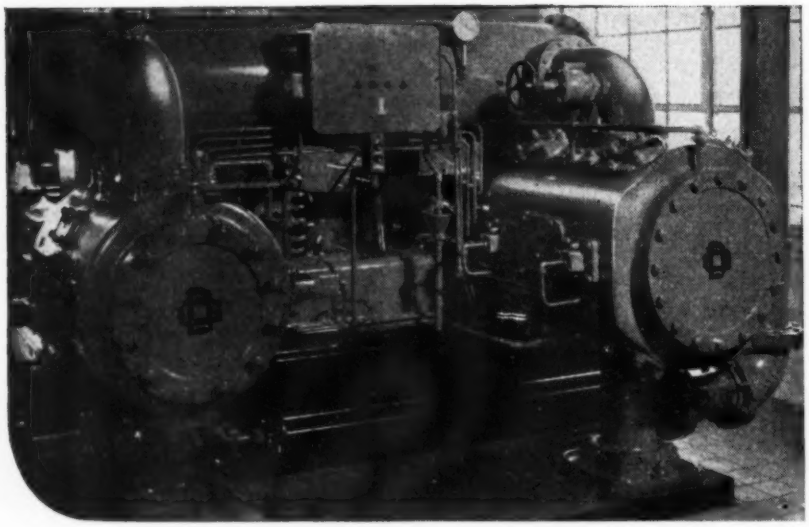
Control of the air—regulation of the flow. Here is a vitally important factor in operating efficiency of a compressor.

You get that positive control in the Gardner-Denver "HA" Horizontal Two-Stage Compressor. Designed for heavy duty, continuous service, the air output of the "HA" is automatically regulated to fit your needs.

Class M-25CS recycling five-step capacity control regulates the output in five steps . . . 100%, 75%, 50%, 25% and 0% of capacity. No wasted horsepower, no unnecessary wear on the compressor. Control is simple, extremely sensitive and without delicate adjustments or fragile parts.

Five-step recycling control.





Other "HA" Features

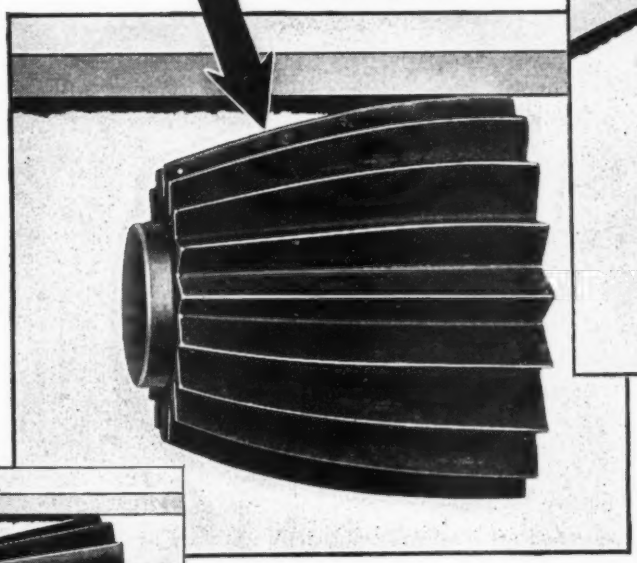
1. Unrestricted air passages and large valve and port areas for greater air efficiency.
2. Timken main bearings for smooth, economical operations.
3. Large water-jacket areas for cooler running . . . lower discharge temperatures and lubricating economy.
4. Rugged, heavy-duty construction for long life and continuous service.
5. To reduce heat and moisture content of air further, for maximum hose and tool life, an efficient "Clean Air" after-cooler is available as additional equipment.

For complete information on the "HA," send for descriptive bulletin. Gardner-Denver Company, Quincy, Illinois.

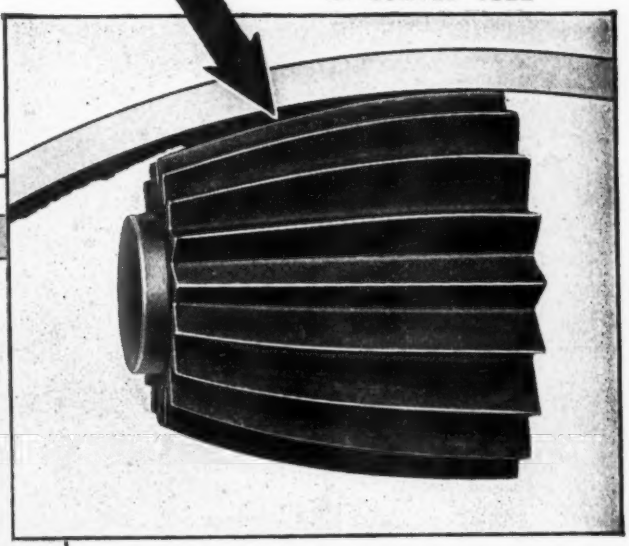
GARDNER-DENVER *Since 1859*

CROWN CUTTERS *do a better job*

IN STRAIGHT TUBE

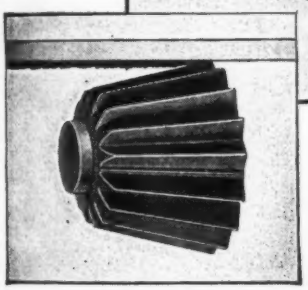


IN CURVED TUBE



At left, the new type cutter in a straight tube. The curved edge of the cutter permits more of its surface to contact the tube and avoids point contact.

Above, the crown cutter in a curved tube naturally and easily conforms to the contour of the tube. More cutting surface is made usable on a crown cutter.



WITH FORMER DESIGN the sharp edge at the rear of the cutter was the only part to meet the tube wall.

Improved cutter design for ELLIOTT *Lagonda Type* TUBE CLEANERS

Rounding the teeth of front cutters removes all possibility of sharp corners scoring tubes, particularly in curved tubes. This cutter is now standard in all Elliott cutter heads using a 1 in. or larger cutter. Except for the rounded center section, the cutter is the same in dimension as the straight sided cutter formerly used, and will be supplied on orders for cutter replacements.

"TRACKLESS", TOO—cutter teeth are so spaced as to avoid striking the same point in repeated rotation inside the tube. At each revolution a tooth attacks a point slightly in advance of the former point, removing all deposit and preventing gear design in the tube. Another safeguard protecting tube inner surfaces.

For up-to-the-minute developments in tube cleaning, come to Tube Cleaning Headquarters. Elliott Tube Cleaner Bulletin on request.

ELLIOTT *Company*

Lagonda Division • SPRINGFIELD, O.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
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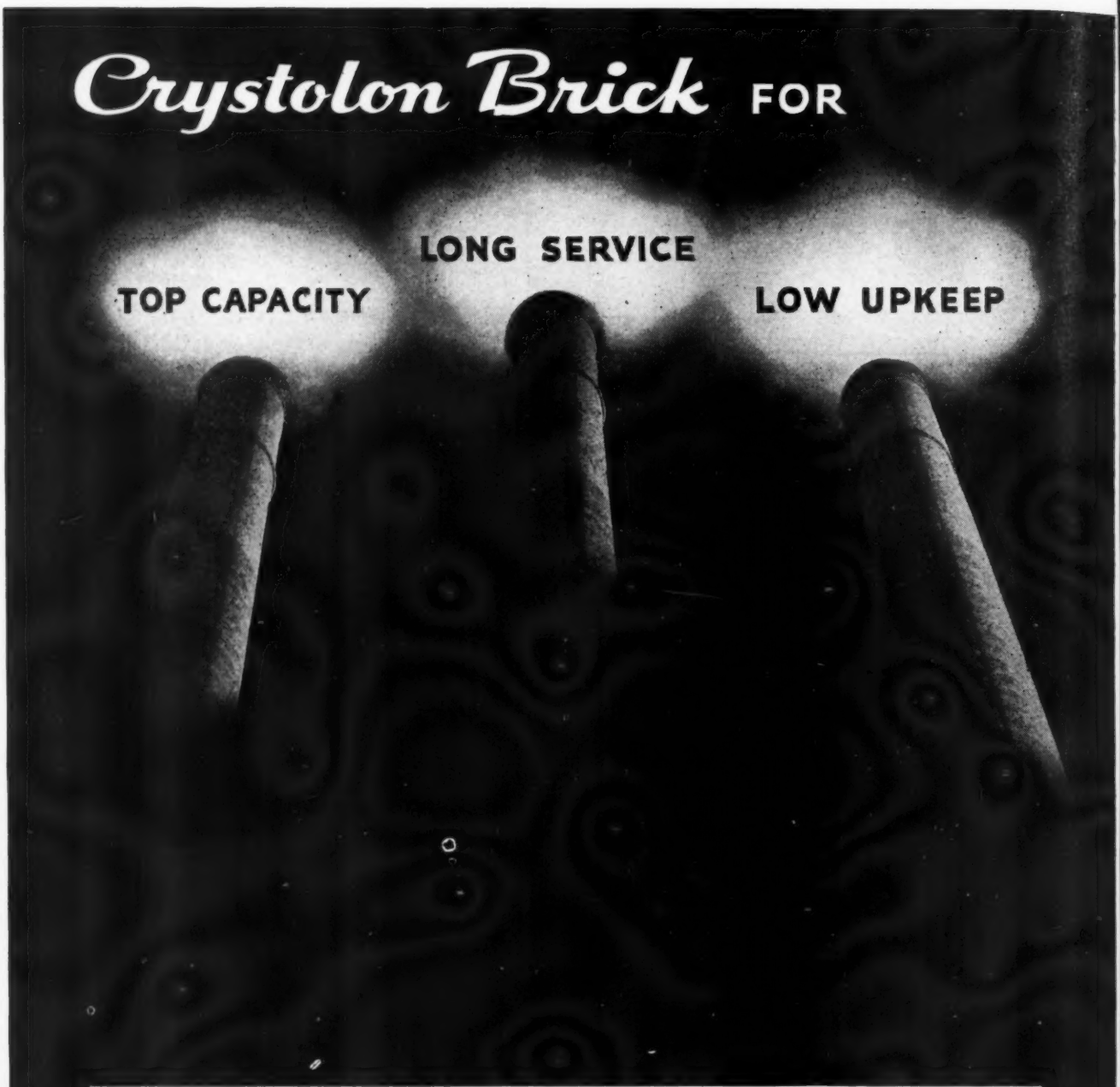
Y-249

Crystolon Brick FOR



CRYSTOLON Brick by Norton will give long, economical service at top capacity and will reduce maintenance time and expense when used at the clinker line of coal-fired boiler furnaces, in the bridge wall and front wall. These highly refractory silicon carbide brick have great resistance to abrasion, to spalling and to the chemical and physical action of molten slag. Slag may adhere to the brick to a very limited degree, but it is easily removed without harming the surface of the wall.

NORTON COMPANY - Worcester 6, Mass.

Norton Longer Lasting Refractories

READY TO SERVE
YOUR
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COFFIN TURBO PUMPS

We have no re-conversion problems. The same standardized Coffin design that served the armed forces and war industries is now ready to meet your requirements for efficient Boiler Feed Pumps. On prompt delivery.

PRESSURES TO 750 P.S.I.
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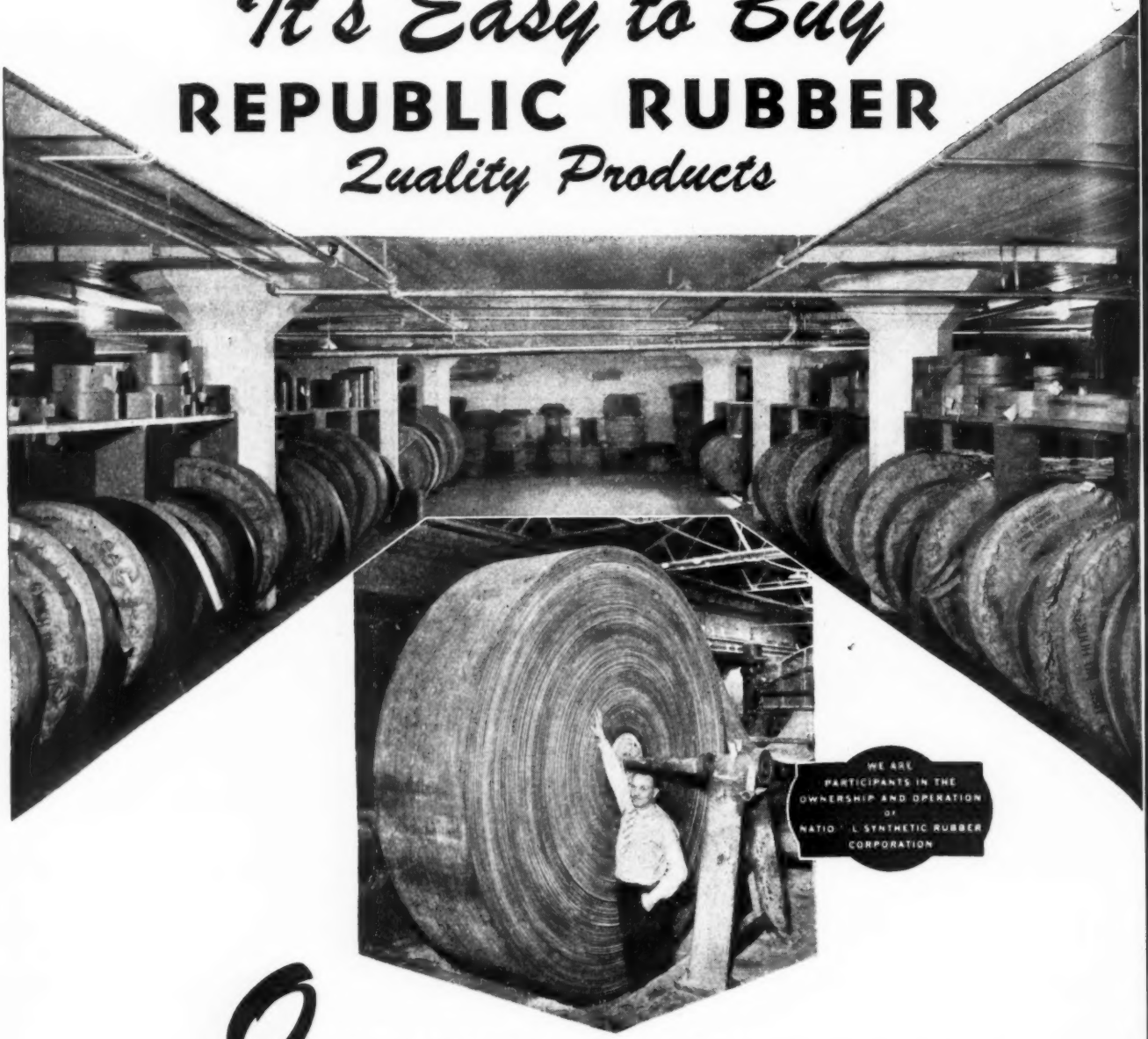
It's Easy to Buy
REPUBLIC RUBBER
Quality Products



ORDER mechanical rubber products from your local Republic Distributor. He is your neighboring businessman and he is qualified to serve you. In most instances, the Republic Distributor can fill orders right from stock—in special cases he gets the factory to build products to your needs. Through these distributors, Republic Rubber products are available throughout the country.

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SIVYER STEEL CASTINGS

for all

CORROSION

HEAT

WEAR-RESISTANT

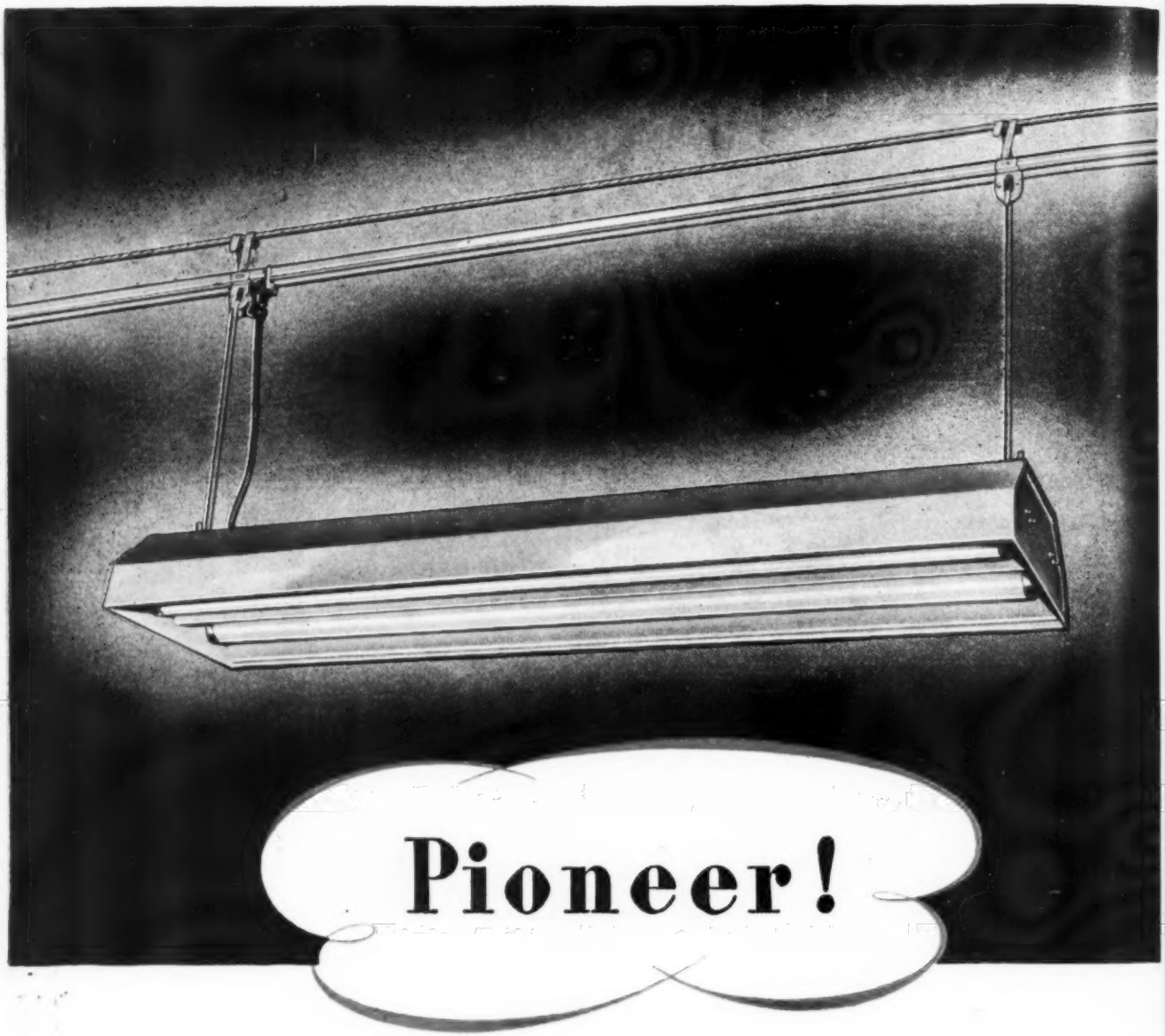
requirements

• If your casting requirements involve strength at elevated temperatures, resistance to oxidation and corrosion—see Sivyer. Here, no matter how diverse your needs, you'll find castings of greater integrity of metal that will reward you with longer, more dependable service. Behind every job are nearly 37 years of steel casting experience—"know how" in every step of production. This skill works for you in the careful planning of castings procedure . . . in modern, scientific laboratory testing and control . . . in correct foundry methods . . . in finishing for greater dimensional accuracy. Altogether it means—castings that get to your job faster, stay there longer. Let Sivyer help in the planning and design of your next corrosion-resistant castings.

ARMY E NAVY

SIVYER STEEL CASTING COMPANY

MILWAUKEE CHICAGO



Pioneer!

BULLDOG UNIVERSAL TROL-E-DUCT

For Completely Flexible Lighting

A thoroughly modern, flexible system of factory lighting pioneered by BullDog—already proved in vital war industries!

Light where it is needed—close to the job—helps both production *quality* and production *quantity*. With BullDog Universal Trol-E-Duct, you can add new lights or re-locate present ones without re-wiring — immediately and wherever needed.

You can even move the whole system anywhere in your plant to accommodate changes in production set-ups. It is prefabricated and built in standard sections—100% salvable, too, nothing to scrap.

Investigate Universal Trol-E-Duct for *your* plant. Adaptable to any type of lighting—fluorescent, mercury vapor or incandescent. Consult expert BullDog field engineers, or write for descriptive folders.

BUY WAR BONDS

BULLDOG

ELECTRIC PRODUCTS COMPANY

SALVAGE PAPER

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities.

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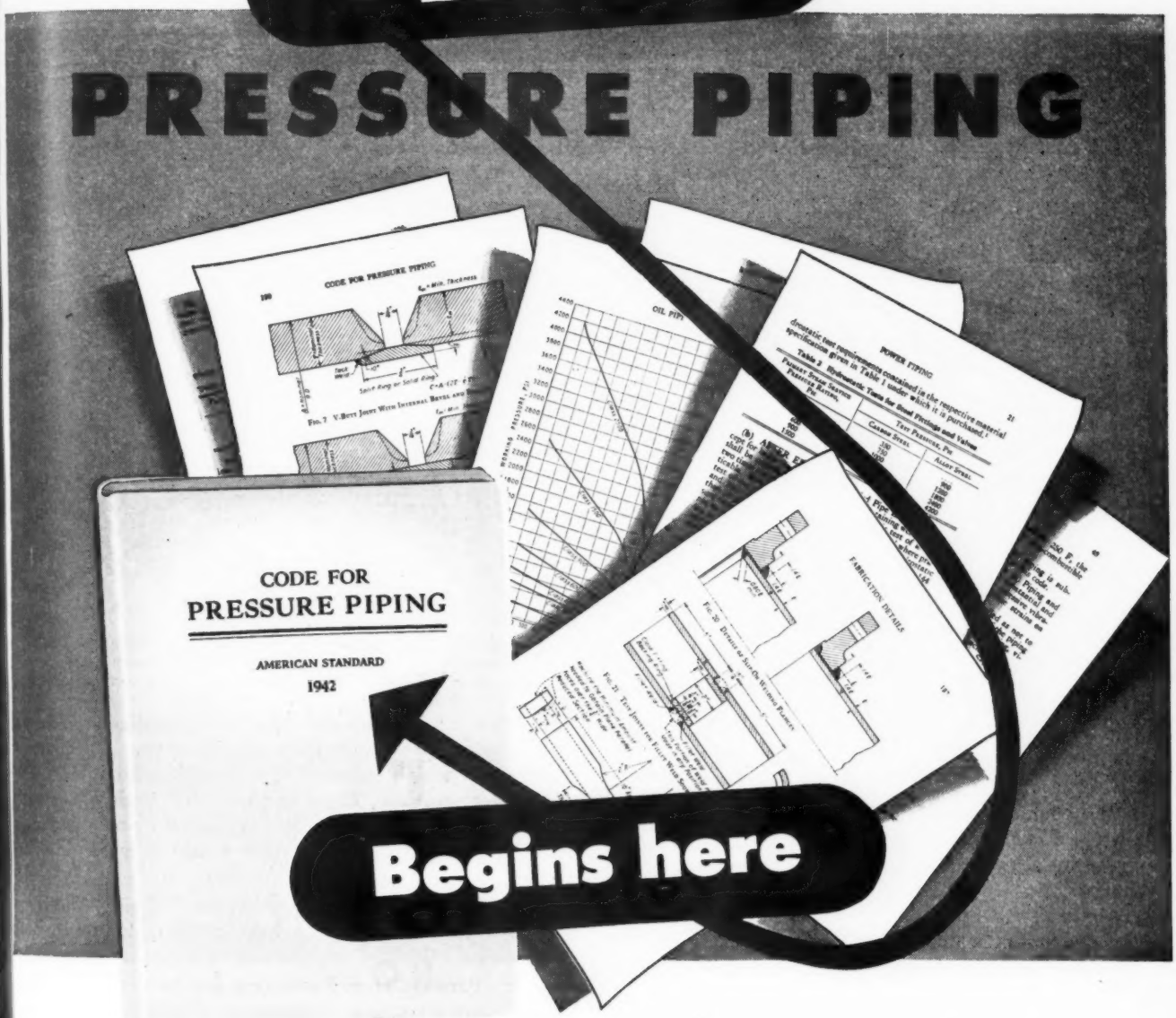
Vacu-Break Safety Switches—SafToFuse Panelboards—Switchboards—Circuit Master Breakers — BUStribution DUCT, for "plug-in" power—Industrial Trol-E-Duct, for movable "loads."

• BETTER PRESSURE PIPING



• This book . . . the revised Code for Pressure Piping . . . contains detailed information on selection of proper materials, dimensional standards, maximum allowable stresses . . . fabrication details such as welded joints, flanged joints, hangers, testing, welding procedure and operator qualification . . . more than 200 pages of useful and necessary information about piping.

Better pressure piping begins with the use of this Code—which is sponsored by the American Society of Mechanical Engineers and approved by the American Standards Association. If you make certain your piping conforms to the Code you may be sure it will not fall below the accepted standards of safety and good practice.

All qualified pipe fabricators comply with this Code. It is essential to the pre-fabrication of quality piping . . . piping that is economical and easy to install.

The Pipe Fabrication Institute will send this Code on request at the established price of $2.00 per copy.

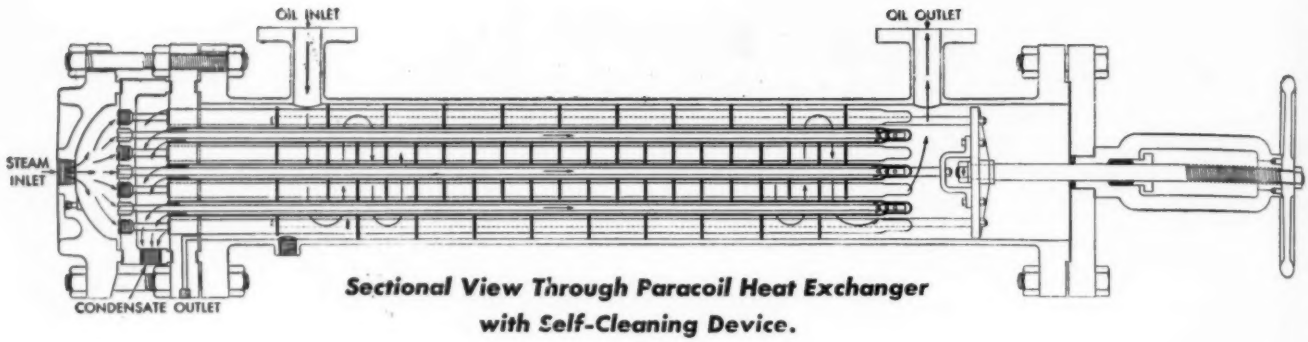
P.F.I. THE PIPE FABRICATION INSTITUTE

G-8

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

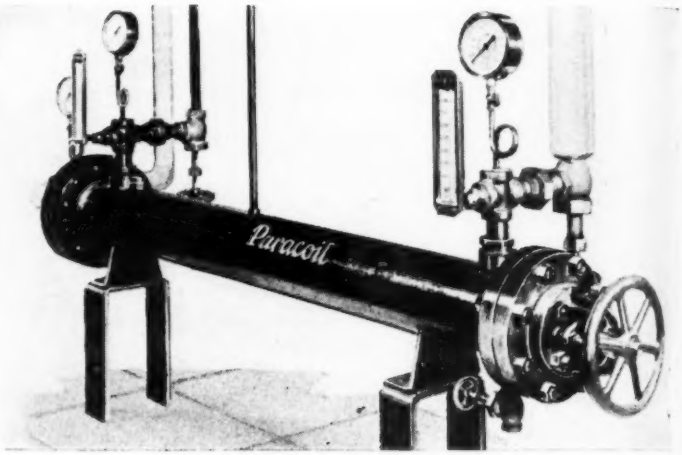


Sectional View Through Paracoil Heat Exchanger with Self-Cleaning Device.

Paracoil

HEAT EXCHANGERS

Built to do a better job



By moving the hand-wheel clockwise and counter-clockwise the entire baffle-assembly is moved back and forth over the heating surface thus scraping any deposits from the tubes. Cleaning action is positive and effective.

ONE OF THE MANY special features available in Paracoil Heat Exchangers is the Paracoil Self-Cleaning Device.

Illustrated is a Paracoil Fuel Oil Heater installation made in a well-known manufacturing plant in 1941. Previously this plant used two straight tube, multi-pass type heaters with the oil in the tubes and the steam in the shell. To maintain oil temperatures necessary for proper combustion and freedom from smoking, approximately sixteen man-hours were used to clean them mechanically approximately *every ten days.*

It will interest plant executives to know that since the Paracoil Oil Heater was installed its Self-Cleaning Device has *eliminated the necessity for this mechanical cleaning* and has kept the heating surface free from fouling without the slightest loss in oil temperature.

Used regularly and periodically, as required by the quality of the oil and the conditions of operation, the Paracoil Self-Cleaning Device permits the prevention of accumulating fouling deposits which decrease heat transfer rates with resulting lowered oil temperatures, and in many cases, inefficient operation.

Two heaters of this same type were installed by a large paper plant for the heating of white water, replacing equipment which required disassembling for tube cleaning *almost every day.* These Paracoil Heat Exchangers with the Self-Cleaning Device have been and are now operating for long periods without this costly disassembly for cleaning.

Paracoil Heat Transfer Equipment is built with *every required factor* of modern heat exchanger design and efficiency.

Every Paracoil Heat Exchanger can be depended upon for uniform operating performance, exceptional economy, rugged construction and long life.

Paracoil Heat Exchangers with other special and exclusive features are available in a wide range of standard equipment. If required, special units can be designed by Davis Engineering Corporation for any heat transfer requisite.

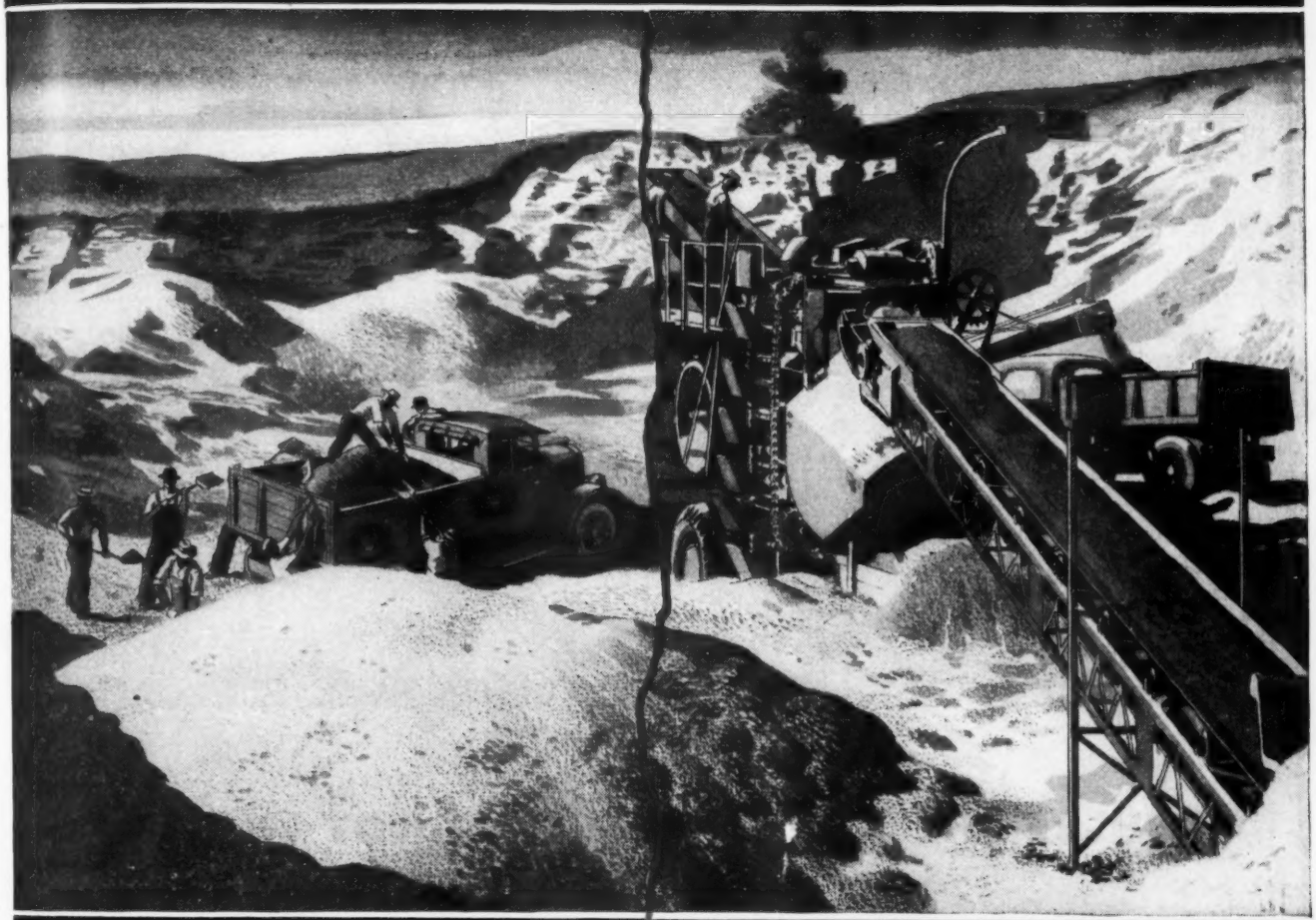
To help you improve your plant efficiency in postwar production, our engineers are at your service to guide you in the selection of proper heat exchange equipment for your specific needs.

Write for Bulletin H-100 describing the Paracoil Self-Cleaning Tubular Heat Exchanger.

SINCE 1915
Paracoil
HEAT TRANSFER EQUIPMENT

DAVIS ENGINEERING CORPORATION
1066 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY

Thermoid —Key to Progress in Many American Industries



LOADING OPERATION BEFORE THE USE OF CONVEYOR BELTING

MODERN LOADING OPERATION USING THERMOID CONVEYOR BELTING

SINCE 1880, Thermoid has contributed to the progress of American Industry. Through three wars, and the intervening periods of peace, Thermoid engineering, research and manufacturing facilities have been devoted to the improved design and production of Industrial Rubber Products. Thermoid stands today in a position, unsurpassed by any competitor, to contribute to the post-war progress of your industry. The Thermoid Line* of belting and hose for materials handling and power transmission may contain the key to another step forward in the improvement of your process and the reduction of your costs. When you call in the Thermoid representative you'll agree with many other manufacturers that—"It's Good Business to Do Business With Thermoid."

***THE THERMOID LINE INCLUDES: Transmission Belting • F.H.P. and Multiple V-Belts and Drives • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Sheet Packings • Industrial Brake Linings and Friction Products • Molded Hard Rubber and Plastic Products.**

Thermoid Rubber

DIVISION OF THERMOID COMPANY

TRENTON, NEW JERSEY

Contributor to Industrial Advancement Since 1880

WHERE THE *Nth* DEGREE IS NOT ENOUGH

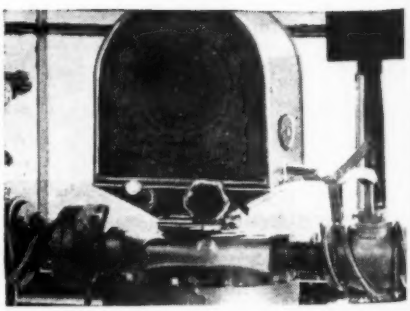
The Chemical Industry Demands Absolute Accuracy...
BOWSER LIQUID CONTROL PROVIDES IT

Infinite care must be exercised in the manufacture of chemicals. Every drop, every particle of every element must be measured, counted, weighed. The finished product must check exactly with the equation. Public health is often at stake. There can be no margin for error.

Precision equipment is a must. That's why you'll find many Bowser Automatic Xacto Meters used by the Monsanto Chemical Co., one of the nation's largest and best known manufacturers of chemicals for industry and the home.

Bowser Xacto Meters are as simple to operate as they are accurate. The quantity predetermining mechanism, with which they can be equipped, assures delivery of the *exact* amount of the liquid desired. There's no chance for error. Bowser Automatic Xacto Meters save time, save labor, save money, prevent waste. And remember, there are many types of Bowser meters and dials for handling a wide variety of liquids.

In the power industry other Bowser Exact Liquid Control equipment—turbine oil conditioners, filters and force feed lubricators for instance—give equally outstanding performance. Impartial experts have definitely proved that oil, if kept perfectly clean, remains as good as new. Bowser Pressure Filters, even under severe operating conditions, are demonstrating their ability to keep oil clean much longer—thus saving money and prolonging the life of the equipment. For complete information, write BOWSER, INC., Dept. 2-J, Fort Wayne 2, Indiana.



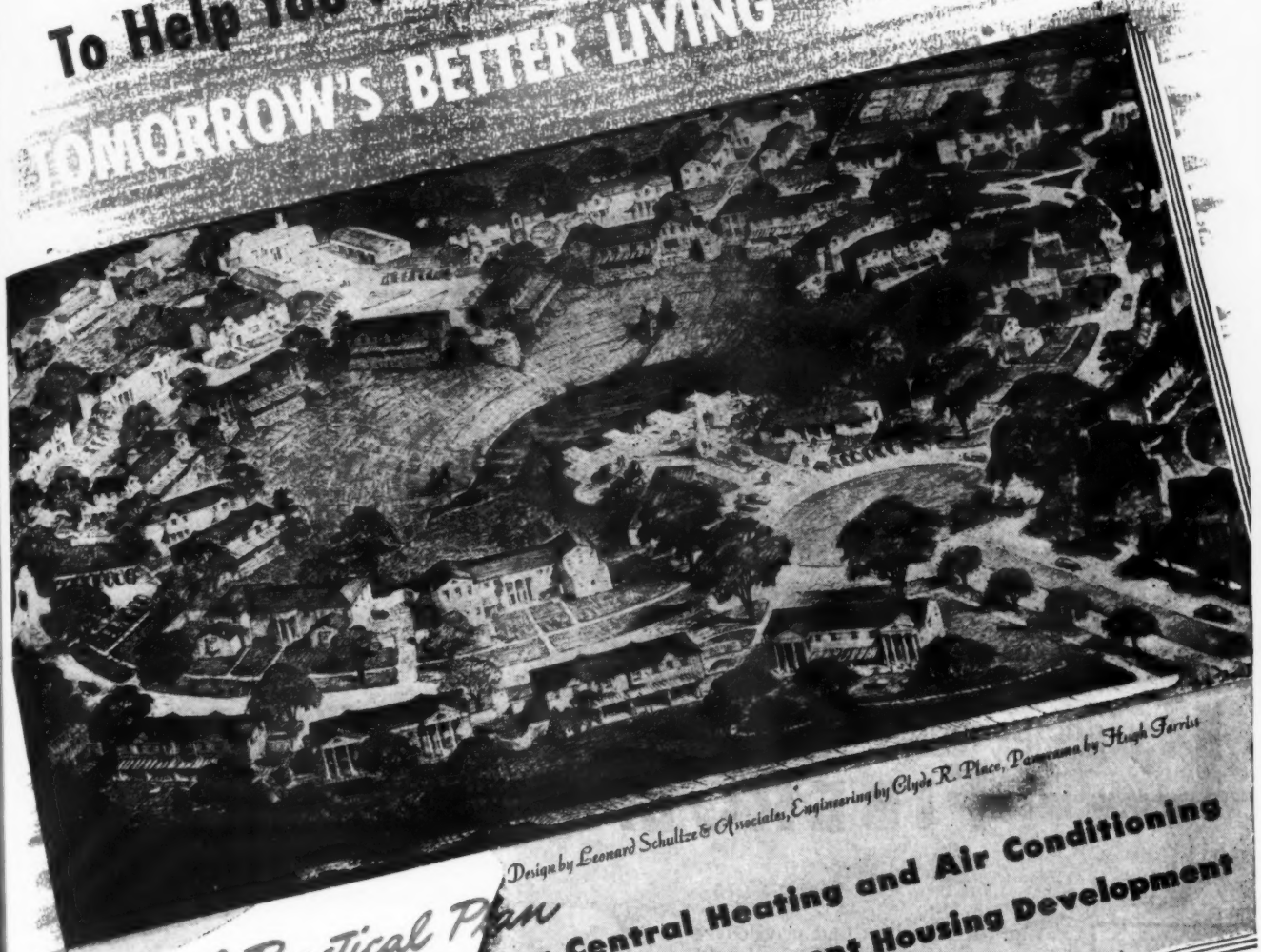
One of the Bowser Automatic Xacto Meters in the St. Louis plant of Monsanto Chemical Company

BOWSER
SINCE 1885

Not only has Bowser's war production earned the Army-Navy E... Bowser equipment has helped earn it for scores of other companies.

THE NAME THAT MEANS EXACT CONTROL OF LIQUIDS

To Help You Plan TOMORROW'S BETTER LIVING



A Practical Plan for incorporating Central Heating and Air Conditioning in a proposed Suburban Apartment Housing Development

This is the first in a series of project studies presented by the Ric-wiL Company, to demonstrate the possibilities and advantages of Central Heating. It discusses in detail—with blue prints, cost figures, etc., the practicability of heating, cooling and supplying other services from a Central Plant. Designed by Leonard Schultze and Associates. Engineering is by Clyde R. Place. The cover illustration is a four color rendering of the project by Hugh Ferriss, noted architectural artist.

Any architect, engineer, contractor, realtor, city commissioner or property owner interested in planning better living conditions for the future will find this book stimulating, inspiring, and completely factual. In addition to the hypothetical apartment community described in detail, it contains actual case histories where Central Heating has proved its many economic and other advantages. This book is our contribution to help you plan tomorrow's better living conditions.

Write for your copy of this Book Today!

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

★ pipe insulation

. . another job for

FIBERGLAS*

In cooperation with the Government program to save critical fuel.

. . . and if it's pipes that need covering — or re-covering — Fiberglas PF Pipe Insulation is the answer. It provides a highly efficient and convenient method of insulating steam and other hot lines of all sizes up to 30" O.D. for temperatures up to 600° F.

Fiberglas PF Pipe Insulation is exceptionally lightweight, consisting of fine glass fibers bonded with a thermosetting binder and molded into hemi-cylinders and segments.

The unusually low thermal conductivity of Fiberglas PF Pipe Insulation produces significant direct savings of heat and power. And the unique characteristics of this material bring installation and maintenance economies that have also helped to win industry-wide approval and acceptance.

Because of its mechanical strength, this pipe covering holds its shape, withstands handling and is easily applied, even on the largest pipes—where only three segments are required. The material is easily cut with a knife and the fibrous ends of sections interlace to form tight joints.

Fiberglas does not rot or decay, disintegrate or pack down under vibration.

For more information on Fiberglas Pipe Insulation or the many other uses of Fiberglas, write for booklet, "Fiberglas Insulations for Industry", *Owens-Corning Fiberglas Corp., 2000 Nicholas Bldg., Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

FIBERGLAS INDUSTRIAL INSULATIONS

1. PF Pipe Insulation—A lightweight, preformed pipe covering with high insulating efficiency for temperatures up to 600° F. Made in 3-ft. sections or segments for all standard pipe sizes. Fibrous ends of sections intermesh to form tight joints.

2. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3" O.D. Will withstand temperatures up to 1000° F.

3. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Lightweight and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

4. No. 600 PF Block—Same materials as in PF Pipe Covering — in blocks 6" x 36" and 12" x 36", standard thicknesses.

5. OC-1800 High Temperature Block—A highly efficient molded block in sizes 3" x 18" and 6" x 36" and 12" x 36"—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

6. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

7. OC Mastic Finish—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

8. Insulating Wool, Type TW-F—Available in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces.

9. PF Insulation—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24" x 48", 1" to 4" in thickness, according to density. For insulated panels, sound absorption and various semi-structural applications.

10. PF Roof Deck Insulation—9 lbs. density with facing to facilitate mopping. Highly efficient, with noncombustible, rotproof and moisture-resistant core, for application under industrial built-up roofings. Sizes 24" x 48". Thicknesses from $1\frac{3}{16}$" to 2".

FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS

War's Over...Let's Go

WARTIME tempo for peacetime production is the keynote to planning a program to "win the peace." We must keep up the pace. Employment levels must be maintained. Absorbing your share of the available man power is a definite patriotic obligation, as well as an economic safeguard.

New standards of quality in workmanship and materials have been evolved, new methods of manufacture, new records in production speed. Conversion of present equipment is inadequate to meet the demand for goods and materials. Obsolescence of much present equipment is inevitable. New, modern, more efficient equipment resulting in greater production economy is the answer . . . it means tougher competition.

The demand is here. Are you prepared to meet it with "enough and on time?"

Let us help you plan your piping requirements. SHOP FABRICATION by trained specialists, in PITTSBURGH PIPING AND EQUIPMENT COMPANY'S modernly equipped shop, means time saved in reconversion, the best piping installation that money can buy, and length of life that will bring a happy reduction in your depreciation figures.

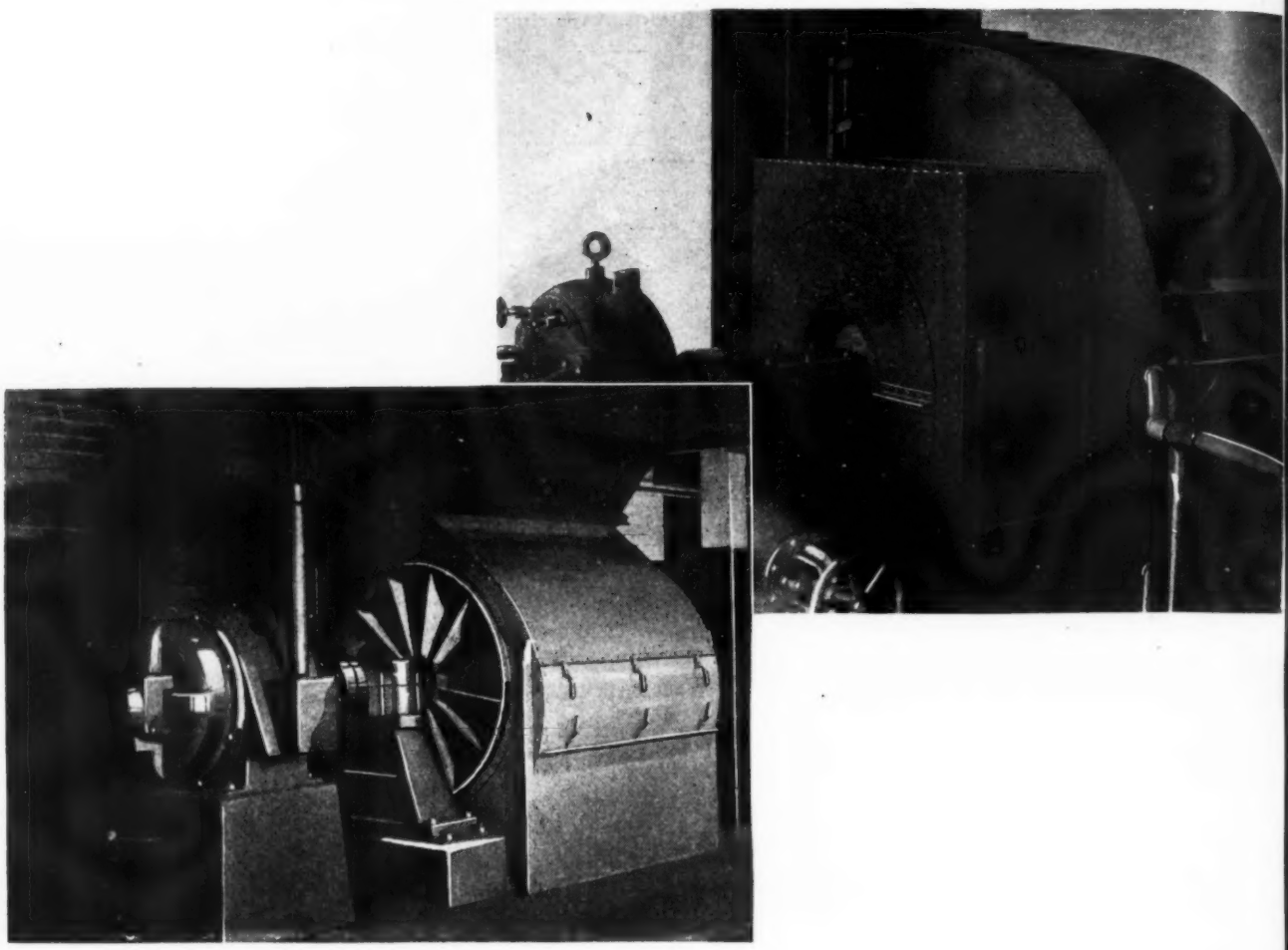
Let our engineers help you plan improvements, additions, or complete new plants. Contact our nearest representative or write us direct. There is no obligation.

BUY VICTORY BONDS

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
634 S. Gramercy Place, Los Angeles

LOWER POWER COSTS
start in the boiler room—



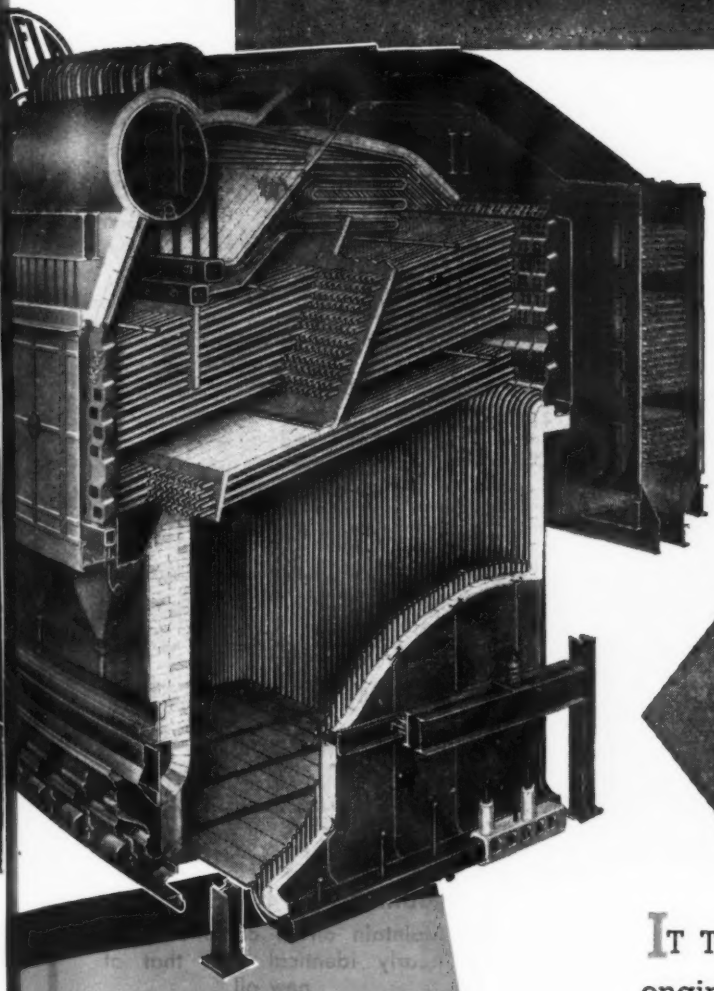
● Every engineer knows that low cost steam comes from good fuel burned at highest efficiency. To get this highest efficiency, draft fans must perform at their peak efficiency. More than this, however, they must "stay on the job" so that shut-downs for fan maintenance are not frequent. Buffalo Forced and Induced Draft Fans have an excellent reputation for durability. They are designed and built by men with a 66-year record of building good fans. Your power plant deserves the best draft fans obtainable. Why not let Buffalo engineers make recommendations.

BUFFALO FORGE COMPANY

488 BROADWAY — BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" **MECHANICAL DRAFT APPARATUS**



CAST STEEL HEADERS — permit tighter rolled tube joints.

SECTIONAL ONE PIECE BAFFLES —make a rugged, permanently tight baffle wall.

STAGGERED GROUP TUBE ARRANGEMENT — gives maximum heat absorption, producing higher efficiency.

SECTIONAL HEADER DESIGN — saves 30 to 60 days erection. Tubes rolled in headers at factory.

PERMANENTLY TIGHT BAFFLES —records show as much as 20 years without maintenance.

SINGLE CROSS DRUM—designed for fast, dry steaming.

It took thirty years...

...to design this boiler!

IT TOOK OVER 30 YEARS and plenty of engineering courage to develop the modern Springfield boiler. In order to bring about higher efficiencies, faster steaming, greater responsiveness to load change, longer life of parts with less frequent and easier maintenance, Springfield engineers had to depart from previous concepts of design.

The fact that the first modern high ratings were accomplished with Springfield boilers is evidence of the success of this course.

For information on units to meet your requirements, write: SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.

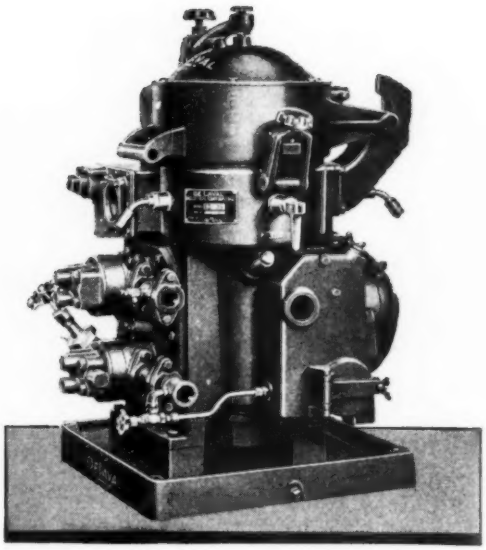
SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

When does a DE LAVAL PURIFIER *Pay for itself?*



A DE LAVAL OIL PURIFIER **nips trouble in the bud . . . it protects your power unit from the unexpected in the lubricating system. A De Laval may save you more than you can ever determine. Why?**

BECAUSE - Bearing trouble—usually synonomous with lubricating trouble—comes at unexpected or inopportune times. When you get a warning it is too late.

A De Laval Oil Purifier removes by centrifugal force both of the trouble makers in lubricating systems—water and dirt, or sludge. On continuous by-pass, it keeps the oil in a condition so pure that it can best be compared with new oil. Hence an adequate supply of purified lubricant is always available, and the danger of bearings being "frozen" is reduced to the vanishing point.

The number of bearings saved—or the amount of "down time" avoided—is difficult to evaluate precisely in such cases, just as it is impossible to evaluate a lightning rod in a storm. The chances are that many, many times in the course of a year a De Laval serves to avoid serious trouble, or even a complete shutdown of power-generating facilities. In other words, sooner or later your De Laval will pay for itself.

• Write for details.

ADVANTAGES OF DE LAVAL LUBRICATING OIL PURIFIERS

Maintain oil in condition most nearly identical with that of new oil

•

Economical to operate

•

Lower power unit maintenance

•

Constant high purifying efficiency—without renewal of functional parts

•

Remove both enemies of good lubricating oil performance: water and dirt

•

Provide maximum protection to power units

•

Give long, trouble-free service

•

Self-draining purifier bowl makes for easy cleaning

DE LAVAL LUBRICATING OIL PURIFIERS

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

IT'S NEW!

THE WEBSTER SELECTROL

Puts All Controls for Unit Heaters in One Cabinet

To get the best out of each Unit Heater installation four controls are necessary: (1) a room Thermostat; (2) a Manual Starter with thermal overload protection;(3)A Summer-Winter Switch; and (4) a Pilot Light. Heretofore these four controls have been installed separately—with separate wiring.

Now the Webster Selectrol gives you *all* four of these controls *plus* a thermometer and terminal block—in a single cabinet—all ready to wire to the electrical service connection and to the Unit Heater. It is just as simple as that.

The Room Thermostat, complete with a temperature setting dial with adjustable locking stops, allows a temperature range of 40° to 80° F. Manual Starter, Summer-Winter Switch, Pilot Light and Thermometer are easily accessible on the removable cabinet panel.

Small and compact, the Webster Selectrol weighs only 6¾ lbs. It can be used with or without separate temperature and pressure limit control devices.

For full information on this newest Webster Product, consult telephone directory for the address of the nearest Webster Representative. Or write us direct for Bulletin B-1700. Address Dept. P-10.

WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating:: Est. 1888
Representatives in principal Cities : : Darling Bros., Ltd., Montreal, Canada

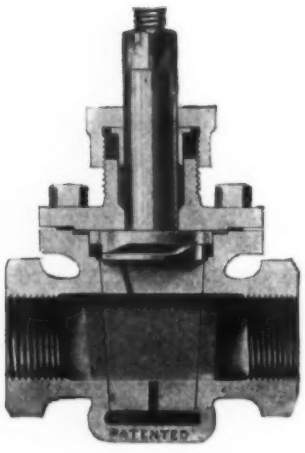
Fuel-Saving Starts With CONTROL

AUTOMATIC Webster Heating Systems

FULL FLOW OR DROP-TIGHT SHUT OFF

A Quarter-Turn Does It!

16 to 28 Times Faster
Than Screw-Stem-Type Valves.



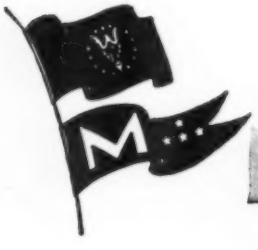
Sectional View (Open Position) Showing Protected Seating Surfaces, Straight-Line Fluid Flow and Rugged Valve Construction.

For quick, positive control in the handling of air, water, gas, oil and other fluids, HOMESTEAD QUARTER-TURN VALVES are unsurpassed. They act quickly and positively because a simple quarter-turn fully opens or closes the valve, and the patented Homestead cam holds seating surfaces in contact at all times, yet permits easy turning.

When the operating handle is moved to the *closed position,* the cam surfaces come into contact automatically, thus pressing seating surfaces together to form a "drop-tight" seal. When the handle is turned to the *open position,* pressure on the cam surfaces is relieved, permitting the plug to turn freely through 90 degrees to a positive stop in the full-open position.

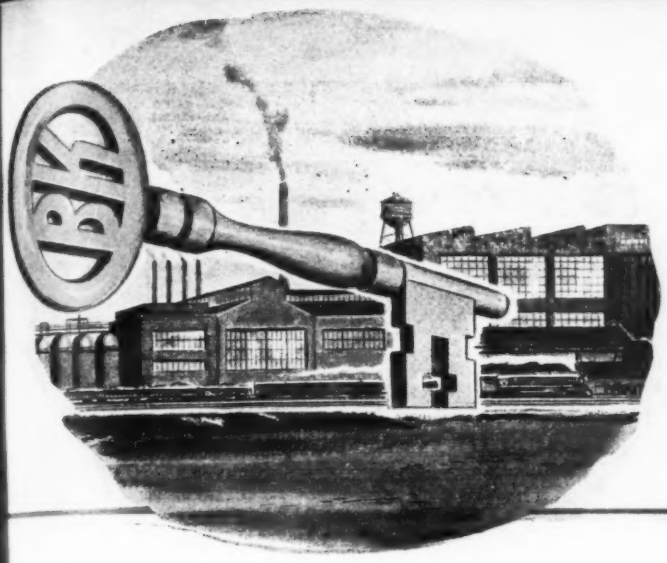
Straight, unobstructed fluid passage, assures "full flow" and minimum drop in line pressure. And because seating surfaces are protected in both open and closed positions, corrosive fluids and grit cannot damage or cause valve failure. Add to these important features the rugged construction characteristic of all HOMESTEAD VALVES and you have the reason why hundreds of users in all types of industry specify HOMESTEAD QUARTER-TURN VALVES for long, trouble-free, low cost service.

HOMESTEAD QUARTER-TURN VALVES are made in sizes, types and metals for most of your valve needs; for pressures to 3000 pounds and temperatures to 750 degrees F. Our engineering department will design special valves to your own specifications. Write for Valve Reference Book No. 38.

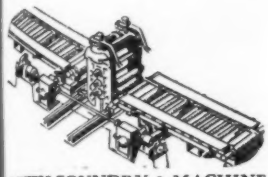


HOMESTEAD VALVE MFG. CO.

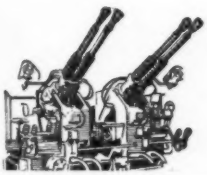
P. O. BOX 210 CORAOPOLIS, PENNSYLVANIA



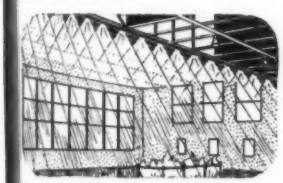
The Key Called "KNOW-HOW!"



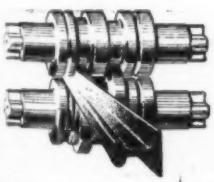
LEWIS FOUNDRY & MACHINE DIVISION . . . Rolls and rolling mill machinery.



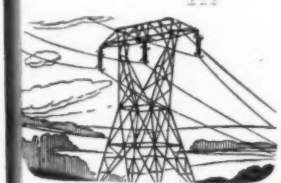
MARTINS FERRY and SPECIAL ORDNANCE DIVISIONS . . . 40 mm anti-aircraft gun mounts and mechanisms.



BLAW-KNOX SPRINKLER DIVISION . . . Automatic sprinkler and deluge systems.



PITTSBURGH ROLLS DIVISION . . . Rolls for steel and non-ferrous rolling mills, etc.



BLAW-KNOX DIVISION . . . Chemical and process equipment, steel plant equipment, construction machinery, transmission and radio towers, steel grating, Standard buildings and hangars, etc.

IT unlocks many doors . . . solves many a pressing problem. You may have the key yourself. But, if not . . .

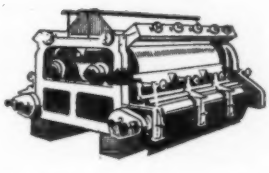
. . . consider Blaw-Knox. Think of its engineering skills accumulated through years of peace and war, its vastly "stepped-up" resources of experience, knowledge and production facilities.

The listing under the various Divisions of Blaw-Knox shown here represents but a small fraction of Blaw-Knox products and services. But it does hint at specialized knowledge in many fields, at research and laboratory facilities, at modern plants, equipment and methods . . . at an engineering background of great breadth and scope.

If what Blaw-Knox has to offer lies within your range, it may well help to provide the answers you need—the hedge you need—against future uncertainties. We ask for an opportunity to discuss this with you.

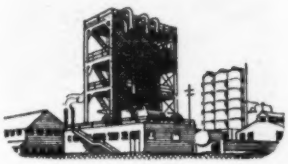
Ask for Blaw-Knox Illustrated Products Book 2055-B

BUY VICTORY BONDS



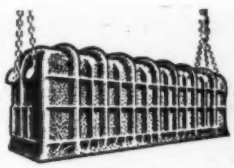
BUFLOVAK EQUIPMENT DIVISION . . . Food processing equipment, evaporators, dryers, distillation and solvent recovery equipment, grey iron castings, etc.

POWER PIPING DIVISION . . Prefabricated piping systems, functional hangers, vibration eliminators, etc.



CHEMICAL PLANTS DIVISION . . . Chemical and process plants from laboratory to production.

NATIONAL ALLOY STEEL DIVISION . . . Heat and corrosion-resistant alloy castings.



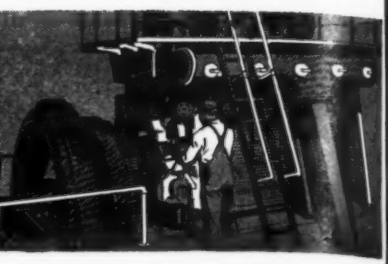
UNION STEEL CASTINGS DIVISION . . . Steel and alloy castings for steel mills and railroads. Gear blanks, pump casings and castings for general industrial usage.

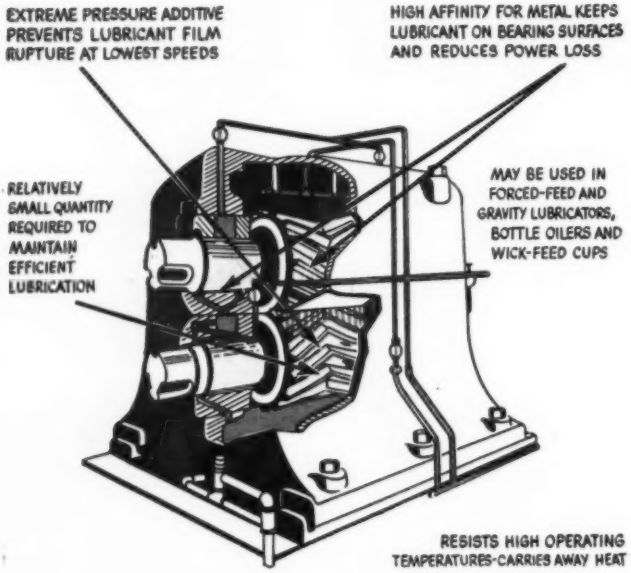
BLAW-KNOX COMPANY

2029 FARMERS BANK BLDG., PITTSBURGH, PA.

A PACEMAKER FOR AMERICAN INITIATIVE AND INGENUITY

STANDARD ENGINEERS NOTEBOOK




EXTREME PRESSURE ADDITIVE PREVENTS LUBRICANT FILM RUPTURE AT LOWEST SPEEDS
HIGH AFFINITY FOR METAL KEEPS LUBRICANT ON BEARING SURFACES AND REDUCES POWER LOSS
RELATIVELY SMALL QUANTITY REQUIRED TO MAINTAIN EFFICIENT LUBRICATION
MAY BE USED IN FORCED-FEED AND GRAVITY LUBRICATORS, BOTTLE OILERS AND WICK-FEED CUPS
RESISTS HIGH OPERATING TEMPERATURES-CARRIES AWAY HEAT

Vistac gives gears extra protection

As the name "Vistac" implies, Calol Vistac Oils are both viscous and tacky giving them a high affinity for bearing surfaces. An oiliness and extreme-pressure additive provides unusual film strength.

They assure full protection to heavy duty gears, such as industrial reduction sets, on which extreme pressures are exerted over wide areas for a relatively long time. They are extremely efficient. Adequate quantities may be supplied to gears by the usual lubrication methods — forced feed- and gravity-lubricators and sight-feed cups; the lighter grades by bottle-oilers and wick-feed cups.

Calol Vistac Oils are also outstanding for the lubrication of rock drills, hammers and other air tools. They atomize quickly, are stable and uniform, and retain their fluidity at low temperatures. They are made in six grades: 9X (SAE 10), 14X (SAE 20), 19X (SAE 30), 28X (SAE 40), 36X (SAE 40), 45X (SAE 40).

High-quality oils increase steam-engine efficiency

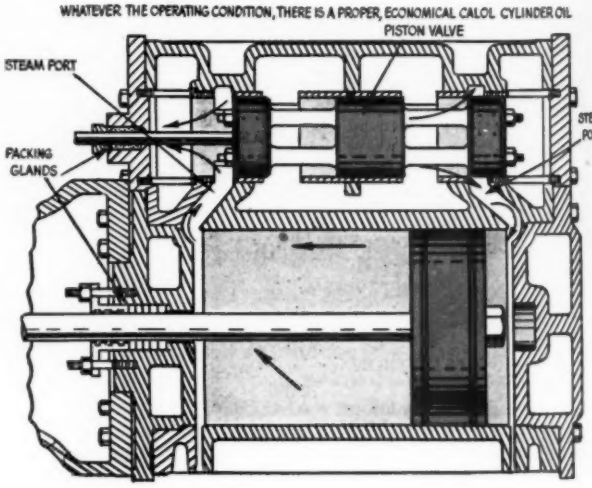
To meet all pressure, temperature and moisture conditions in steam engines, there are several special types of Calol Steam Cylinder Oils.

In severe conditions, one of these three compounded paraffinic oils often helps engines develop extra power:

Calol Cylinder Oil—125PX. Medium viscosity. For high speeds and heavy loads; pressures to 150 lbs. gauge, temperatures to 400° F.

Calol Cylinder Oil—140PX. Medium viscosity. For dry and saturated steam as well as slight moisture conditions. To 160 lbs. gauge; 450° F. May also be used in oil-type enclosed reduction gears.

Calol Cylinder Oil—155PX. Medium-high viscosity. For pressures up to 225 lbs. gauge; temperatures, 550° F.

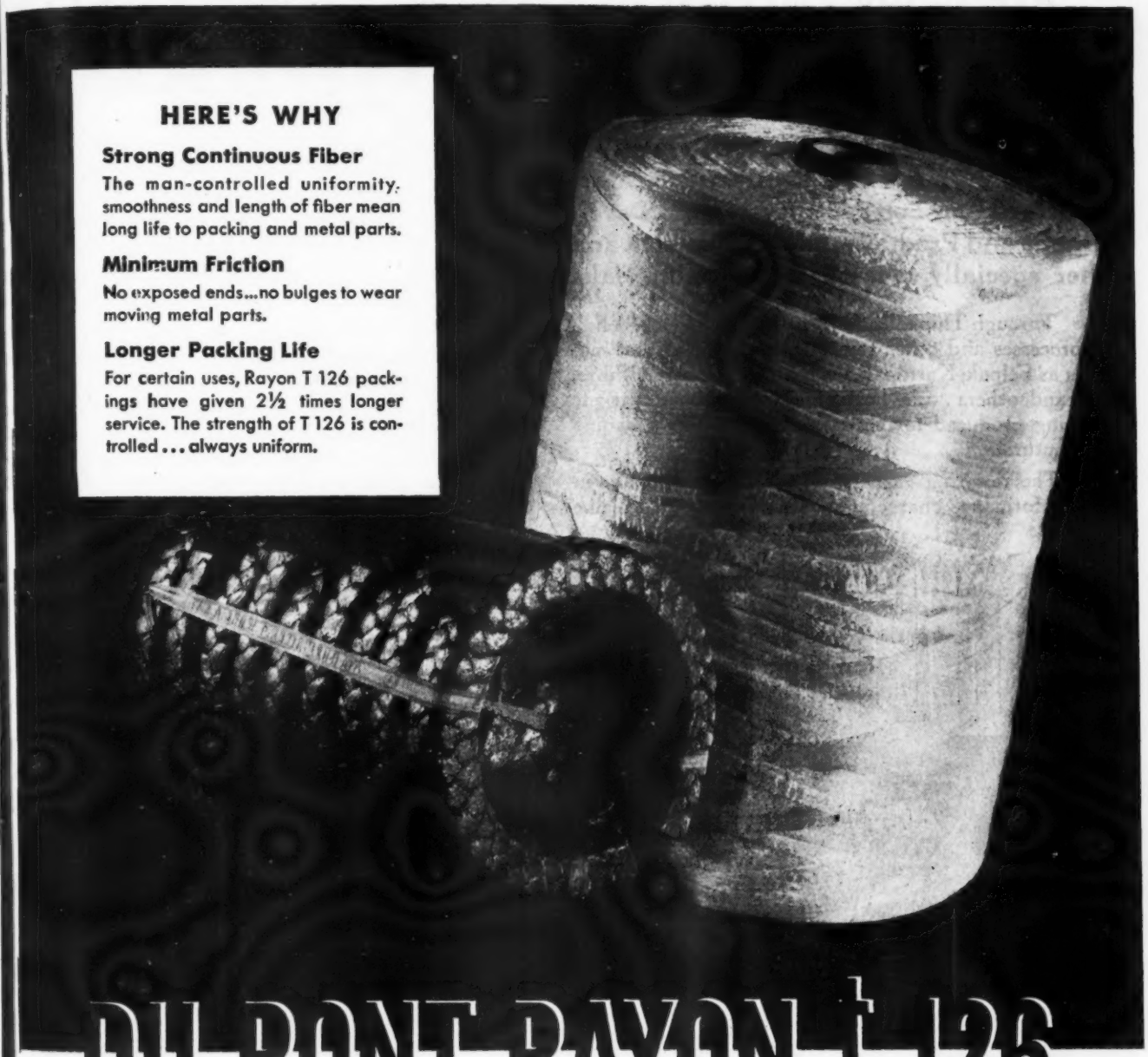

WHATEVER THE OPERATING CONDITION, THERE IS A PROPER, ECONOMICAL CALOL CYLINDER OIL
PISTON VALVE
STEAM PORT
PACKING GLANDS
STEAM PORT
COMPLETE ATOMIZATION AND FREE FLOW ASSURE MAXIMUM DISTRIBUTION AND PROTECTION

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

Du Pont Recommends Rayon Fiber Packing

(ALL LEADING PACKING MANUFACTURERS CAN SUPPLY IT)



HERE'S WHY

Strong Continuous Fiber
The man-controlled uniformity, smoothness and length of fiber mean long life to packing and metal parts.

Minimum Friction
No exposed ends...no bulges to wear moving metal parts.

Longer Packing Life
For certain uses, Rayon T 126 packings have given 2½ times longer service. The strength of T 126 is controlled ... always uniform.

DU PONT RAYON T 126

the precision packing fiber

Ask your suppliers for hydraulic packings fabricated of this new man-made, man-controlled fiber—Du Pont Rayon T 126. Developed to meet wartime needs, it has proved superior to top grade fibrous packing for many uses.

New uses are developing steadily. Already, Rayon T 126 is used for service against cold or hot water and brine in pump rods, plungers, rams, elevator plungers, accumulators, centrifugal and reciprocating pumps.

All leading manufacturers are ready to ship packings made of Du Pont Rayon T 126. It's the coming thing in the fibrous packing field for many uses. Order a trial run from your packing supplier. Use as he recommends.

DU PONT

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Rayon Department, E. I. du Pont de Nemours & Co. (Inc.) . . . Wilmington 98, Delaware

How Thousands of Gasket Improvements

are being effected by Fel-Pro Developments in

Thiokolized Gaskets

For that New Design...or Re-Design! *Investigate Today* the 2 BIG ADVANTAGES resulting from Fel-Pro's Pioneering Development and Production of Thiokolized and other specially treated Gasket Materials.

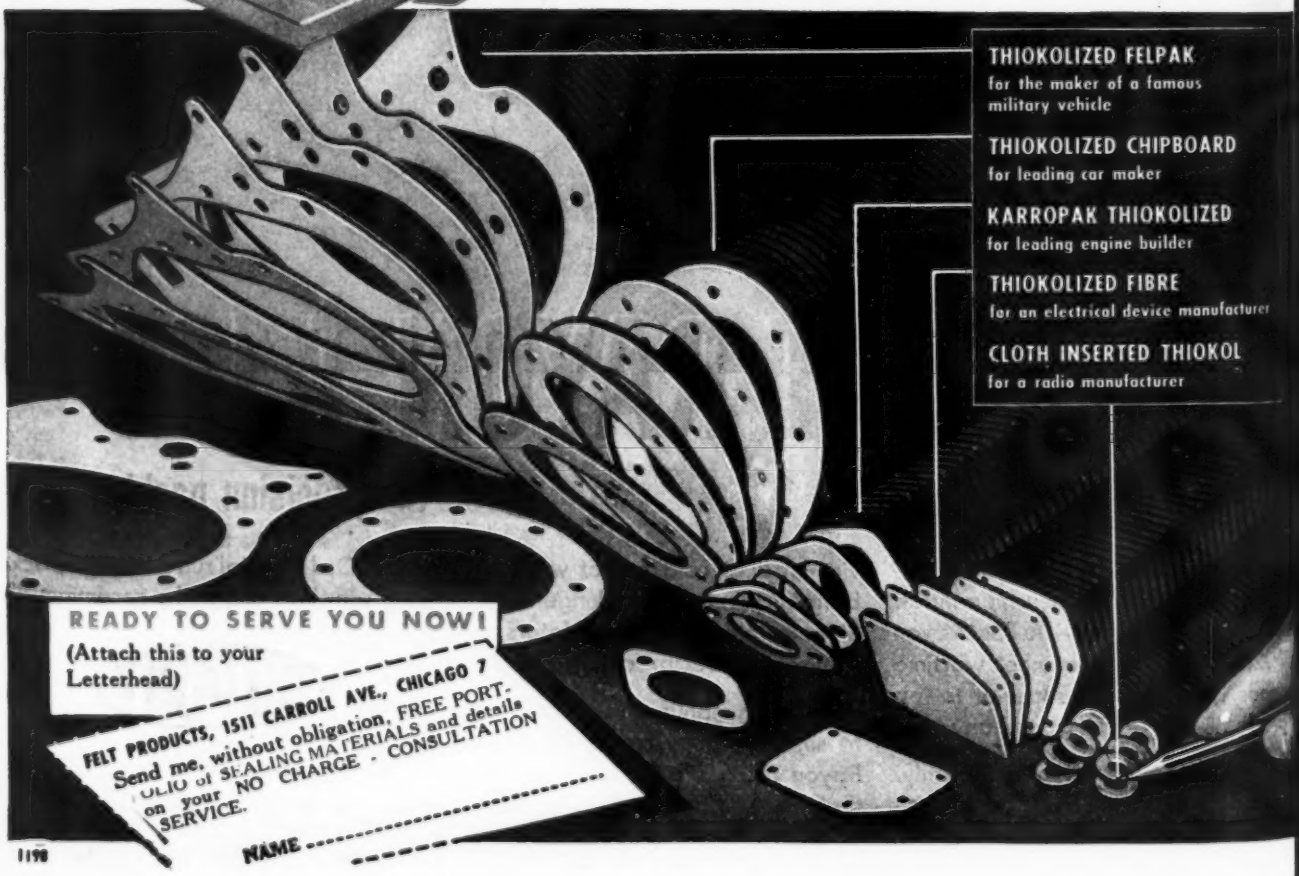
Through Thiokolizing by specially developed Fel-Pro processes and other treatments of such gasket materials as Felpak, Karropak, Fishpaper, Chipboard, Fibre, Cork and others . . . a host of new, improved gaskets are being produced for thousands of America's leading manufacturers.

The resulting gaskets are often revolutionary in their performance characteristics as applied to specific product requirements. Most of these gaskets were developed originally to meet a specific specification . . . the need of a car builder for a more durable, oil resisting gasket . . . the requirement of an electrical device maker for a similiar material with high insulating and sealing qualities . . . the need of an auto accessory maker for an oil resisting gasket with tremendously high tensile strength...etc.etc.

Fel-Pro not only has the Know-How, resulting from years of experience, to provide the proper gasket for your requirements, (that's advantage 1) but also (advantage 2) the PRODUCTION KNOW-HOW to produce them ECONOMICALLY and to highest quality standards. ***Write Today for*** **FREE PORTFOLIO OF LATEST SEALING MATERIALS *and further details of our*** **NO CHARGE CONSULTATION SERVICES.**

FEL-PRO tect

with Sealing Materials, Gaskets, Packing, Sound and Vibration Dampeners, Washers, specially die-cut, treated and fabricated by FELT PRODUCTS MFG. CO., 1511 CARROLL AVE., CHICAGO, ILL.


THIOKOLIZED FELPAK
for the maker of a famous military vehicle
THIOKOLIZED CHIPBOARD
for leading car maker
KARROPAK THIOKOLIZED
for leading engine builder
THIOKOLIZED FIBRE
for an electrical device manufacturer
CLOTH INSERTED THIOKOL
for a radio manufacturer
READY TO SERVE YOU NOW!
(Attach this to your Letterhead)
FELT PRODUCTS, 1511 CARROLL AVE., CHICAGO 7
Send me, without obligation, FREE PORTFOLIO of SEALING MATERIALS and details on your NO CHARGE - CONSULTATION SERVICE.
NAME

1198

Graduation Day in a Gauge Factory

ONE OF THE REASONS 6 OUT OF 10 PICK U. S. GAUGES

"COMMENCEMENT EXERCISES" FOR A GAUGE

When all of the dozens of parts that make up a commercial U. S. Gauge have been constructed and assembled, they pass to Final Testing for a last check up. They have been inspected and approved over and over again during the course of completion but the final O.K. slip is the "diploma" which sends U.S. Gauges to their appointed jobs.

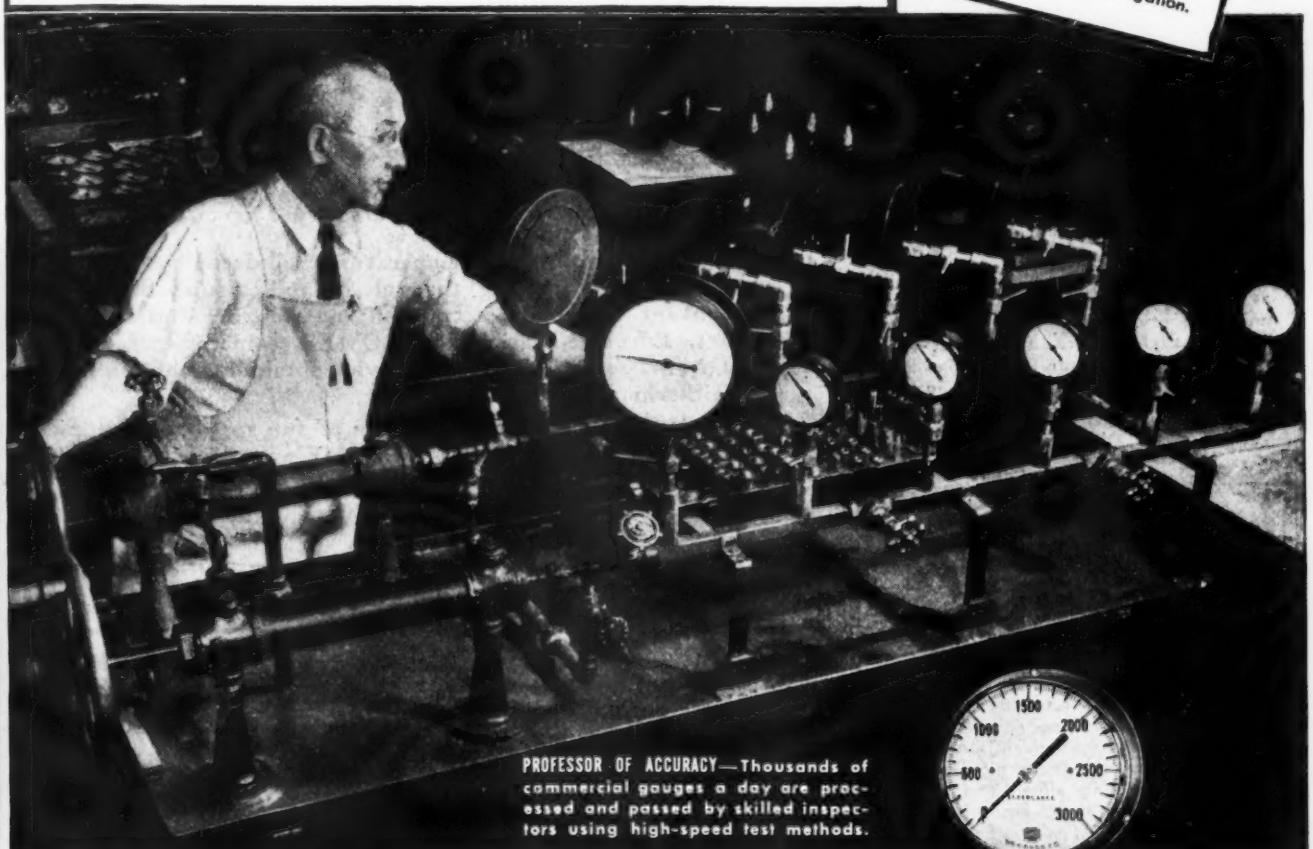
WHY 6 OUT OF 10 CHOOSE U. S. GAUGE

Final Testing is obviously important to you. But of more importance to you if you could only see it at work is U. S. Gauge's *Manufacturing Control*. Our "MC", as we call it, watches every step from raw material to final testing. It's the real reason 6 out of 10 buyers choose U. S. Gauge.

US Gauges

RESERVE YOUR COPY OF THE MOST COMPLETE GAUGE CATALOG EVER COMPILED!

In a matter of weeks, the 102 page U. S. Gauge catalog will be off the press. We are now taking reservations for this largest of all catalogs. You'll want this complete up-to-date information on gauges, gauge movements, and gauge manufacture with its easy ordering guide. Reserve your copy on your business letterhead. No obligation.



PROFESSOR OF ACCURACY—Thousands of commercial gauges a day are processed and passed by skilled inspectors using high-speed test methods.

UNITED STATES GAUGE CO.

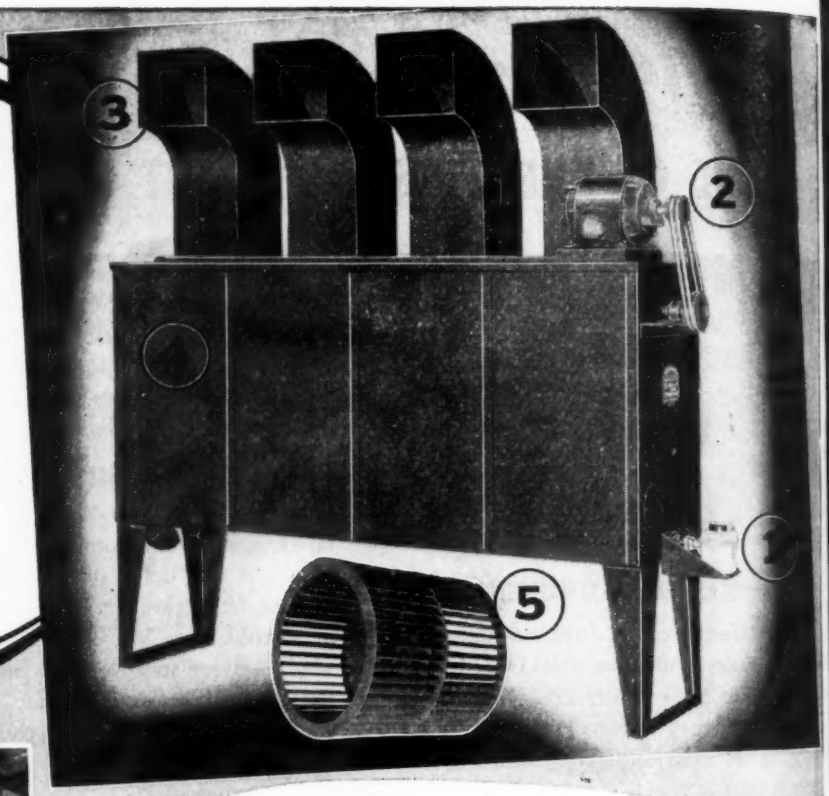
SELLERSVILLE, PA.

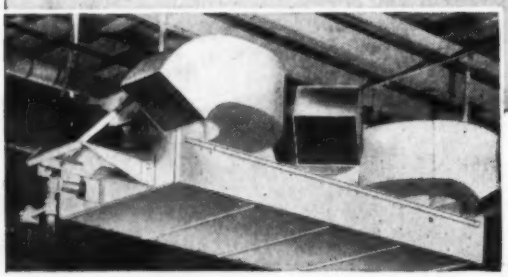
Manufacturers of Pressure, Temperature, Flow and Electrical Measuring Instruments

U.S. INSTRUMENTS Tell The Truth

USG

Give These Features Some Study - and REDUCE Your Heating COSTS!





Floor or Ceiling Installation

Unitherm Heaters can be furnished either as floor or suspended type units. Floor type units are preferable where space permits. They are slightly more efficient in operation, and they simplify your layout considerably saving in pipe and trap costs. Suspended type units can be easily installed along walls or at ceiling line.

CLARCO HEATERS for SMALLER JOBS

These propeller type, suspended units are adaptable for small space heating and for places where more heat is required than present equipment can supply. Also suitable for heating offices and stores. Very quiet in operation. Easily installed along side walls or at ceiling line.

CLARAGE

Unitherm Heaters Offer:

1. **Syncrotherm Control:** temperatures regulated by the amounts of return air passing through or/and around heating coil. Constant warm air circulation; no stopping and starting of fans. Effective heating with LOWER temperature air; *important fuel savings.* Patented device obtainable only on Clarage Unitherm units.
2. **V-Belt Drive:** permits regulation of fan speed to meet widely varying conditions; insures QUIETER operation. (Direct drive if desired.)
3. **Square Outlets:** easily removable and adjustable for four different directions of heat flow.
4. **All Parts Readily Accessible:** merely remove front (or back) section of heater casing which is fastened to frame with machine screws.
5. **Centrifugal Fans:** one for each heater outlet. Pressure type delivering heat at high velocity over wide areas.

*Liberal range of sizes to meet all kinds of industrial heating jobs, operating on steam or hot water. Prompt deliveries. Have Clarage engineers submit complete recommendation. Write or phone us today!

ARMY (E) NAVY

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo 16, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

It's what happens

HERE

and

HERE

that destroys ordinary belts

—but not Condor Compensated

PATENTED

TRADE MARK REGISTERED

with its EQUALIZED PLY STRESSES

In ordinary belt, as it goes around the pulleys, there is a constant alternation of "stretch and buckle" stresses—different for each ply—which speed outer ply rupture, shorten belt and fastener life.

The way the Strength Members are made and applied in the construction of Condor Compensated Belt lets it flex freely and with ***equalized ply stresses.*** This patented and exclusive ***Compensation*** principle represents what is probably the most beneficial development in belt construction of the last quarter century.

Reports like these indicate the kind of service you get from Condor Compensated:

An 8-ply, 16-inch Condor Compensated Belt on a paper mill drive is "still performing like new" after 9 years.

"100% more starting load capacity without appreciable belt slip." . . . Many users report 3 to 4 times longer fastener life from Condor Compensated.

"After the second flood receded, we again dried out the belts. Today they are as good as the day we put them on (2 years) and we have not even had to take them up."

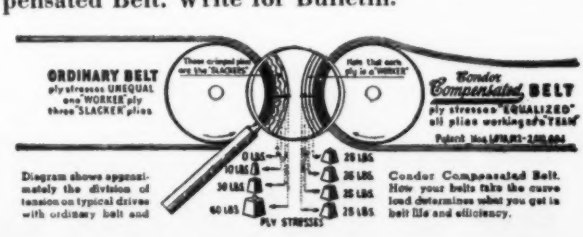
Advantages of Compensation

In all styles of Condor Compensated Belt, you get these belt-saving, production-building advantages:

1. Ruptures in outside ply eliminated
2. Freedom from ply separation
3. Longer fastener life
4. Can be operated over smaller pulleys
5. For heavy loads, plies may be increased with same pulleys
6. Higher overload capacity or margin of safety
7. Less wear on pulley side
8. High production efficiency
9. Material reduction in belting costs

Also available with Style H surface for low tension operation, Style F with friction surface on the pulley side, and Style B with bareback surface on pulley side, where some slip is desirable.

Improve your production now with Condor Compensated Belt. Write for Bulletin.


ORDINARY BELT
ply stresses UNEQUAL
one "WORKER" ply
three "SLACKER" plies
Those crimped plies are the "SLACKERS"
Note that extra ply is a "WORKER"
Condor Compensated BELT
ply stresses "EQUALIZED"
all plies working as "TEAM"
0 LBS
10 LBS
30 LBS
60 LBS
25 LBS
25 LBS
25 LBS
25 LBS
PLY STRESSES
Diagram shows approximately the division of tension on typical drives with ordinary belt and
Condor Compensated Belt. How your belts take the curve load determines what you get in belt life and efficiency.

CONDOR BELTS are now made in the dark, war-time color.

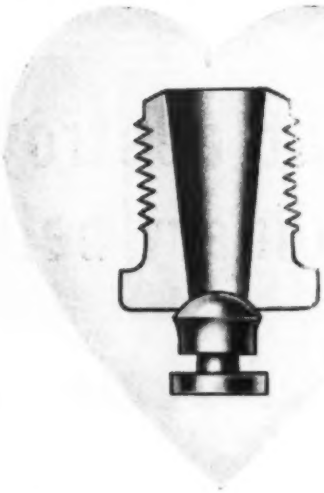
THE MANHATTAN RUBBER MANUFACTURING DIVISION

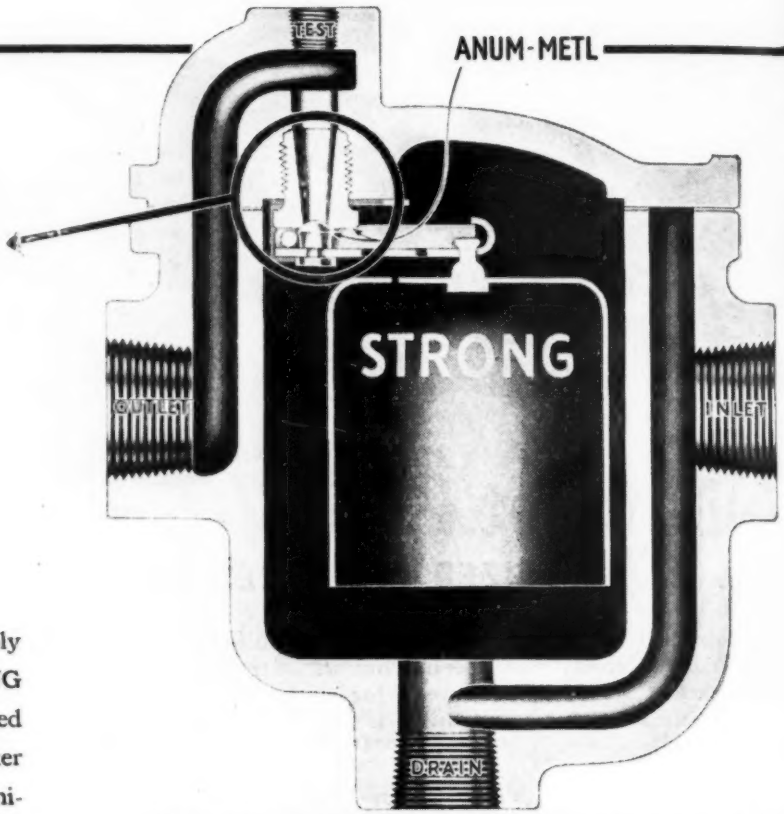
of RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES and FACTORIES . . . PASSAIC, NEW JERSEY

New HI-CAP Orifice Gives STRONG Traps

UP TO 25% GREATER CAPACITY





HI-CAP* Valve and Seat Assembly ... the heart of the improved STRONG Trap. New, scientifically designed orifice throat gives up to 25% greater capacity, avoids turbulence and minimizes choking caused by flash steam.

*HI-CAP—Registered trade mark

An important part of STRONG service is continued attention to parts for traps in service. HI-CAP parts are available for your present 70 series traps.

OTHER FEATURES OF THE NEW HI-CAP TRAP

NEW lever design gives quick, full opening without dribbling.

NEW renewable seat permits easy servicing.

NEW inlet-outlet location places trap below level of inlet pipe at all times.

Write for New Bulletin on HI-CAP Traps

STRONG, CARLISLE & HAMMOND COMPANY

Over 40 Years of Steam Specialties

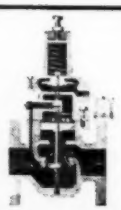
CLEVELAND 13, OHIO

REG. TRADE MARK

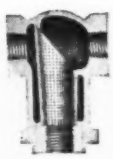
OTHER ANUM-METL Reg. Trade Mark

STRONG

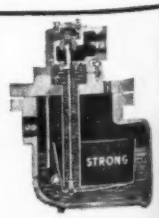
STEAM SPECIALTIES



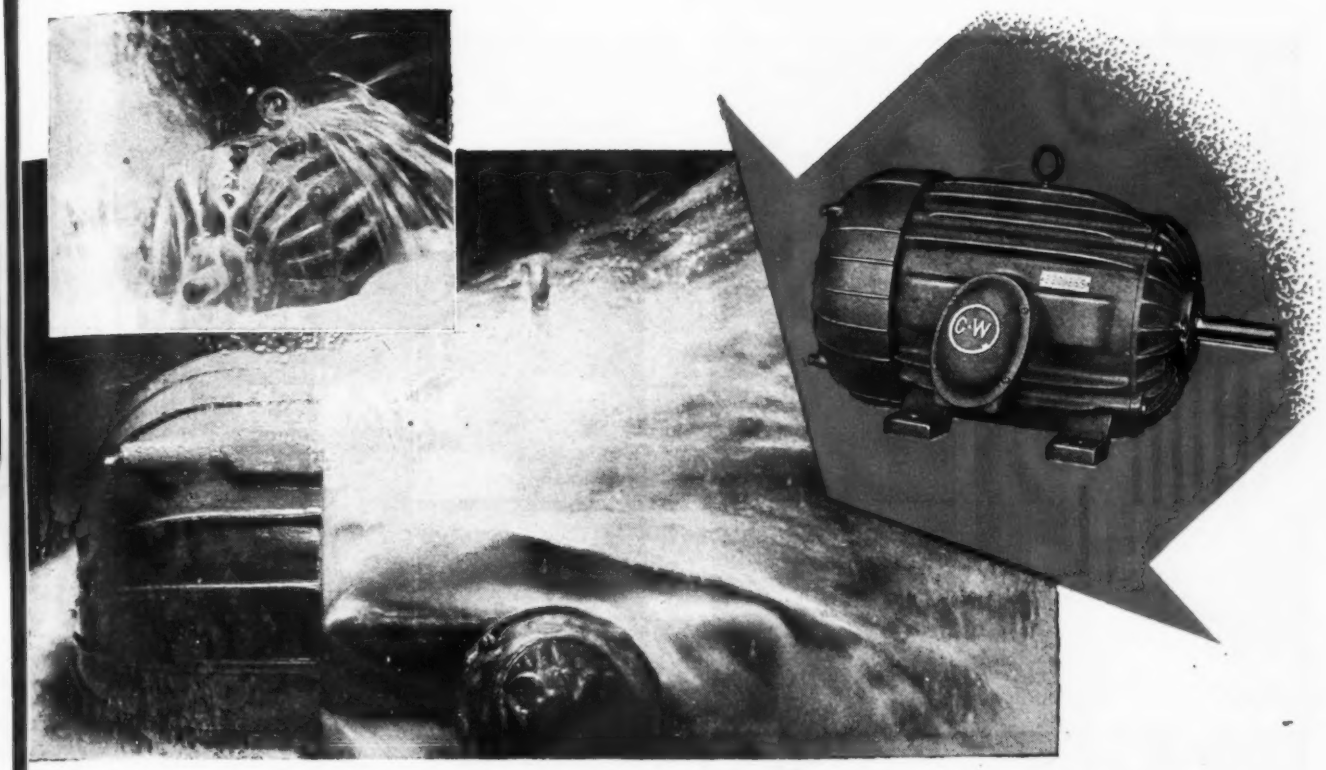
Reducing Valves



Strainers



Large Capacity Traps



A MOTOR takes a bath to prove a point

You can easily see that this new a-c **SEALEDPOWER** is a unique motor—with many exclusive features—but how will it stand up under really tough operating conditions? Can it withstand excessive moisture? What will be the effect of large quantities of dust in the surrounding atmosphere?

Answers had to be found to these questions before the motor could be offered to industry as an *improvement* over existing fan-cooled designs. So two brutal tests were devised:

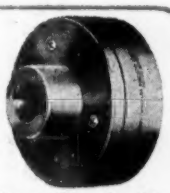
In performing the first test a standard **SEALEDPOWER** motor was placed in a tank containing six inches of water, and run for eight hours without stopping; it was then shut down and the operation repeated the following day. All during the operating period the ventilating fan of the motor continued to throw water over the frame, shields, bearing housings, shaft and junction box (see illustrations), thoroughly drenching the entire exterior of the motor and yet, at the end of the test, the motor was taken apart—and the inside was found to be "bone" dry! Excessive moisture will offer no problem to this motor.

In the second test, a dense atmosphere of French chalk was kept whirling around the motor by means of fans. But, at the conclusion of this test, not a trace of chalk was found on the windings or elsewhere within the motor—conclusive proof that the **SEALEDPOWER** motor is truly dust tight.

An exclusive Crocker-Wheeler design, the **SEALEDPOWER** motor is suitable for applications where you have been using conventional fan-cooled motors. Why not try one of these motors—in an unusually damp or dusty location?

Send for full information. Please write on your company letterhead—no obligation.

THIS COUPLING IS UNIQUE, TOO



The Crocker-Wheeler resilient flexible coupling consists of a spider, a flange, a ball retaining cover and six synthetic rubber balls—that's all there is to it! And yet, this is more than just a trouble-free coupling—it actually adds years to the life of both the driving and driven machines.

The balls transmit torque, absorb shock and vibration, yet do not transmit end thrust. Available for shaft diameters up to 8", these couplings require no lubrication, no maintenance of any kind. Write for complete information.

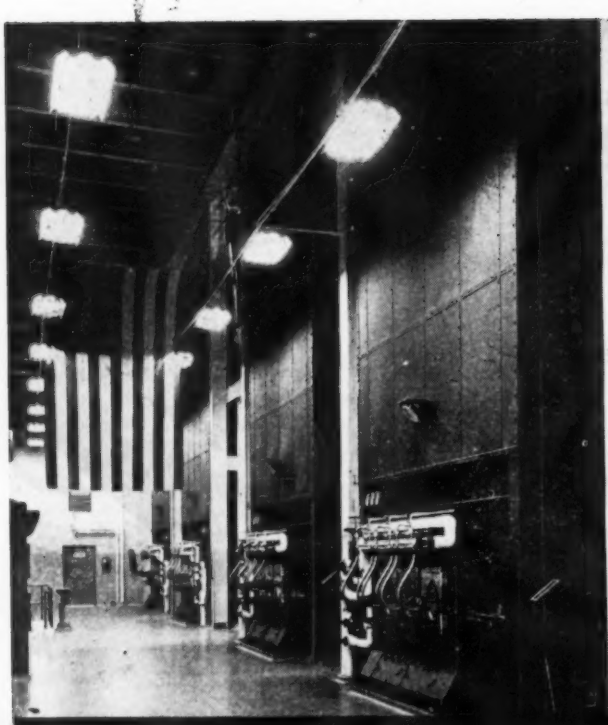
CW-7

CROCKER-WHEELER ELECTRIC

A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE 35, NEW JERSEY

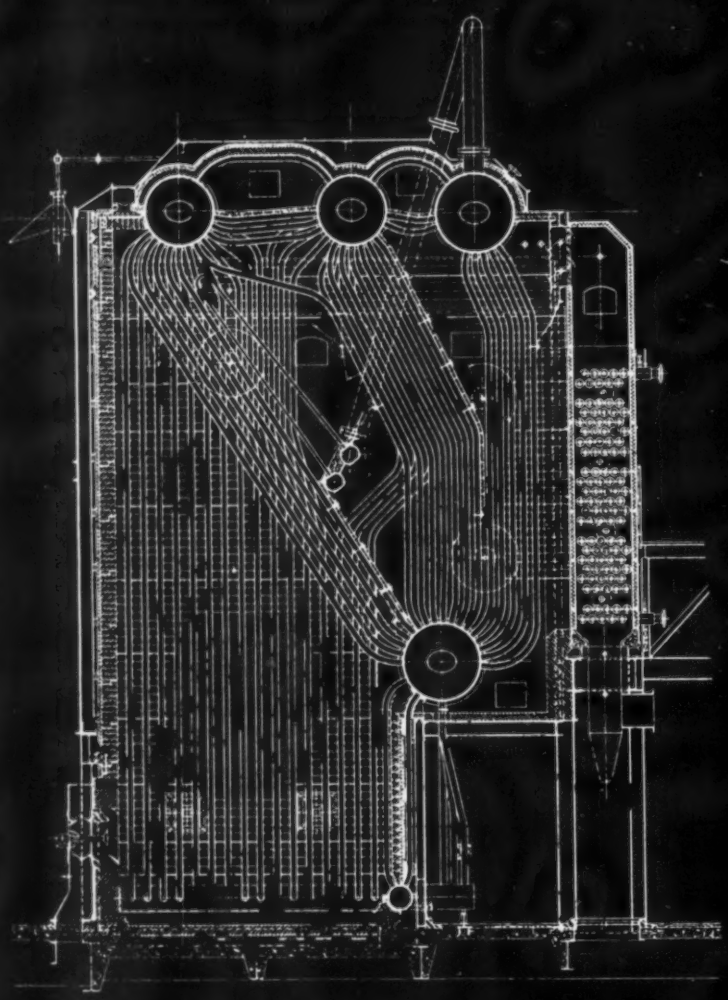
Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

SQUIRREL CAGE MOTORS | WOUND ROTOR MOTORS | DIRECT CURRENT MOTORS | GENERATORS | FLEXIBLE COUPLINGS



Wickes

4-DRUM WATER TUBE BOILERS



Wickes 4-Drum Boilers of welded construction incorporate the engineering knowledge and fabricating skill of more than fifty years experience in the building of efficient boilers.

There are many important characteristics that enable these Wickes Boilers to stand up on the job and perform so effectively; large diameter drums, minimum number of tube bends, unrestricted circulation and sufficient steam liberating area to assure rapid response to load changes with high quality steam. These boilers are available for pressures up to 1,000 lbs. per square inch and capacities up to 350,000 lbs. of steam per hour. For additional information on any type of industrial boilers write to:

THE WICKES BOILER CO.

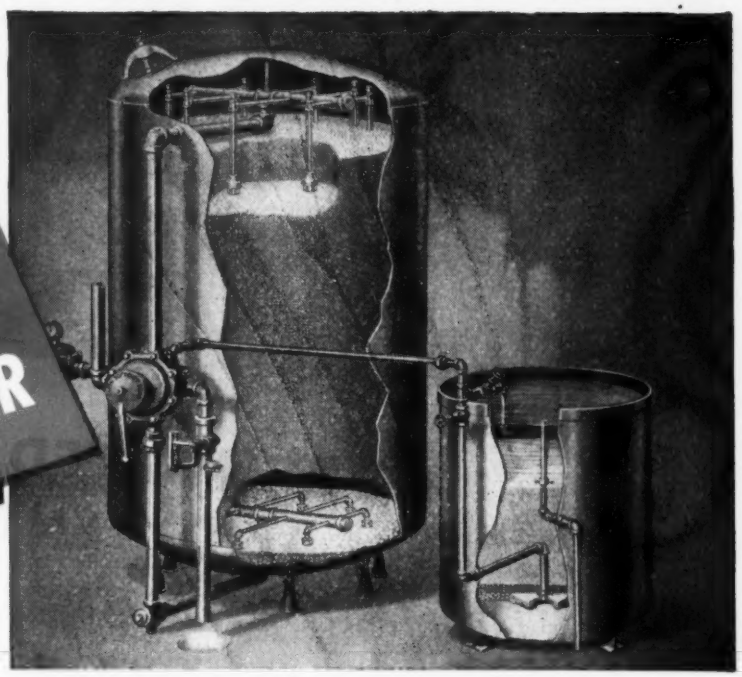
SAGINAW, MICHIGAN

(Recognized quality since 1854)

NOW AVAILABLE

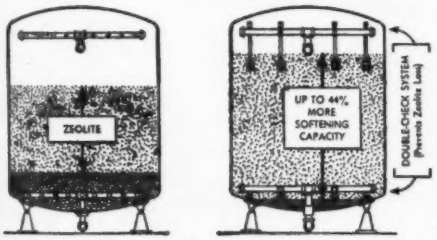
postwar design

ELGIN WATER SOFTENER



. . . delivers up to 44% more soft water

NOTE THE INCREASED CAPACITY



ORDINARY WATER SOFTENER DESIGN

ELGIN WATER SOFTENER DESIGN

HERE'S HOW TO STEP UP THE OUTPUT OF YOUR PRESENT WATER SOFTENER

The "Double-Check" equipment can be installed in place of the present manifold in your zeolite softener regardless of make. This change, along with Elgin High Capacity Zeolite, will give you greatly increased soft water output. The cost of this modernization is surprisingly low. Let us give you facts.

• Here's real news for users of zeolite water softener equipment. Our postwar design is now available. It delivers up to 44% more soft water than any other unit of equal size. Of importance is the fact that this new water softener has been fully proved by gratifying results in a long list of plants where it is already in service.

An improved double-check type manifold prevents the escape of zeolite and therefore permits placing a far greater amount of water softening zeolite in the softener, as shown. More zeolite means more soft water output—for it's the zeolite that does the softening.

But that isn't all. A higher backwashing rate is also made possible by preventing loss of zeolite. This higher rate cleans the softener thoroughly. With the zeolite bed clean, the salt reaches every grain of zeolite. The result is better regeneration with less salt consumption . . . higher over-all efficiency.

The whole story of tomorrow's water softener today is told in brand new bulletin 606. Write for your copy today.

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The complete Elgin line—Boiler Water Treating and Purifying Systems • Feedwater Treatment • Deconcentrators • Heat Exchangers • Water Softeners • Filters and Purifiers • Iron Removal Equipment • Aerators • Water Treating Chemicals • Chemical Feeders • Scale and Corrosion Inhibitors • Sample Coolers • Water Testing Equipment • Zeolites

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CORRUGATED PIPE
AND BENDS
ADAPTABLE • LESS STRESS • SAVED SPACE
In problems involving high forces or moments due to thermal expansion, Navco Corrugated Pipe and Bends are frequently the only solution.
By reducing the bending stresses and minimizing the end reactions, a safe design is insured which perhaps could not otherwise be obtained.
Whenever you have any unusual Piping problems, consult Navco.
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NAVCO
NAVCO PIPING

A fast way to get motors...

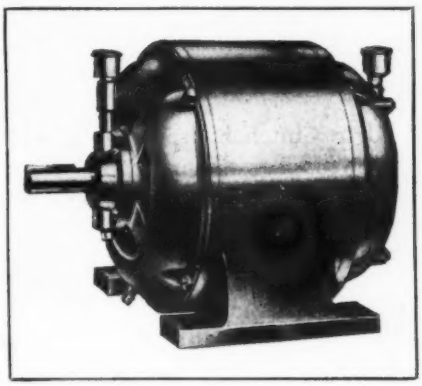
This suggestion is not addressed to buyers who use standard motors, although for them Star also has good news: Star began production of a large range of standard motors for stock weeks ago, and early delivery of some of these can be made.

To makers of products which require a motor that is somewhat "special" in frame design or mounting arrangement, Star's Welded Steel Construction may be a time-saver of great importance *right now*.

Star pioneered this method of construction, and developed unique production welding facilities to save the time and money that went into patterns and castings once required for "special motor" customers.

Exceptional strength and shock resistance is also gained through Star's Welded Steel Construction. This led to extensive use of Star Motors by the Navy long before the war.

A number of prominent concerns, needing motors that vary from standard, have found that Star can help them to get motors faster than they thought possible. Star may be able to reduce *your* wait for motors. To find out, send a description of your requirements to Star Electric Motor Co., 228 Bloomfield Avenue, Bloomfield, New Jersey.



AC and DC Motors ⅛ to 200 HP;
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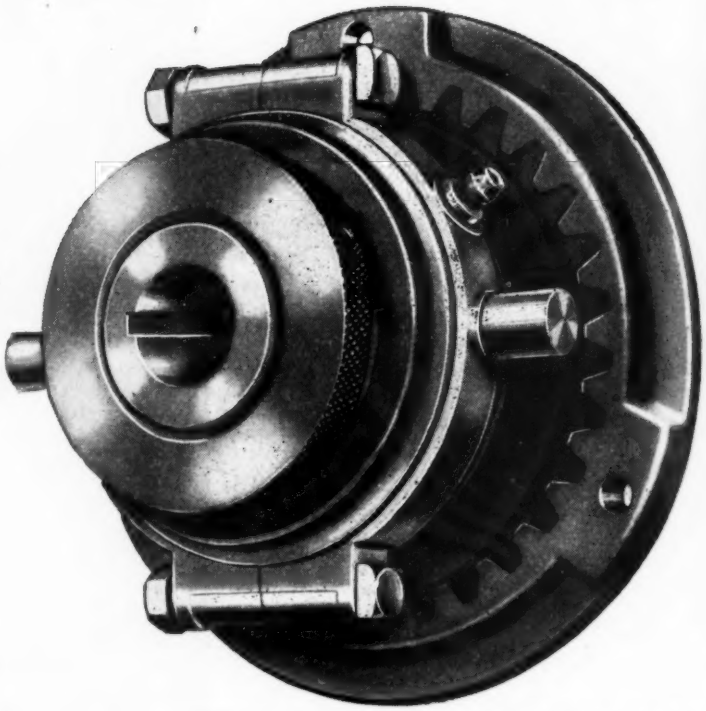
STAR MOTORS

POWER PACKAGED AS YOU NEED IT

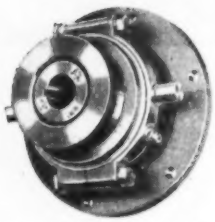
ROLLING GRIP

A GREAT NEW DEVELOPMENT IN FRICTION CLUTCHES

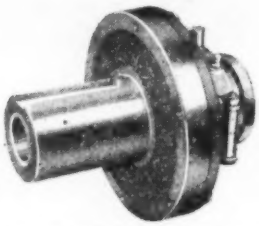
No Toggles! In the Dodge Rolling Grip Clutch, power transmitting pressure is developed by a circle of hardened steel balls. These are forced into a wedge-shaped groove by the sliding cam. The cam and groove contours utilize the basic mechanical principle of the wedge to multiply the force exerted on the shifter collar into a much greater force on the friction disc.



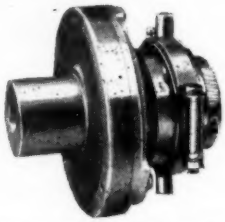
Dodge Rolling Grip Friction Clutch Gear Tooth Mechanism



Dodge Rolling Grip Friction Clutch Bolted Plate Mechansim



Dodge Rolling Grip Friction Clutch With Sleeve



Dodge Rolling Grip Friction Clutch Cut-off Coupling

Another achievement of Dodge Transmissioneering—designed to give outstanding flexibility and ease of control to light machinery, without any sacrifice of positive drive—and available at low cost!

The Dodge Rolling Grip Clutch is especially adapted to bread wrapping, sewing, floor scrubbing, bag making, tobacco, textile, and other such machines. It is rugged, compact, easy to adjust. And it is available from Dodge distributors' stock. Call the Dodge Transmissioneer in your territory for information about this and other new developments in power transmission equipment.

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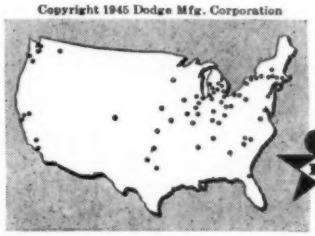

There are 257 Dodge factory graduate Transmissioneers, located in principal cities, to show you new and better ways of transmitting power.

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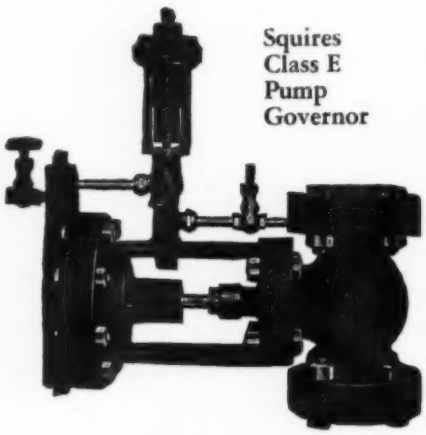

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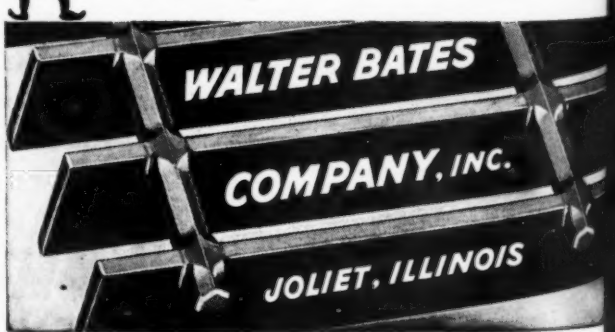
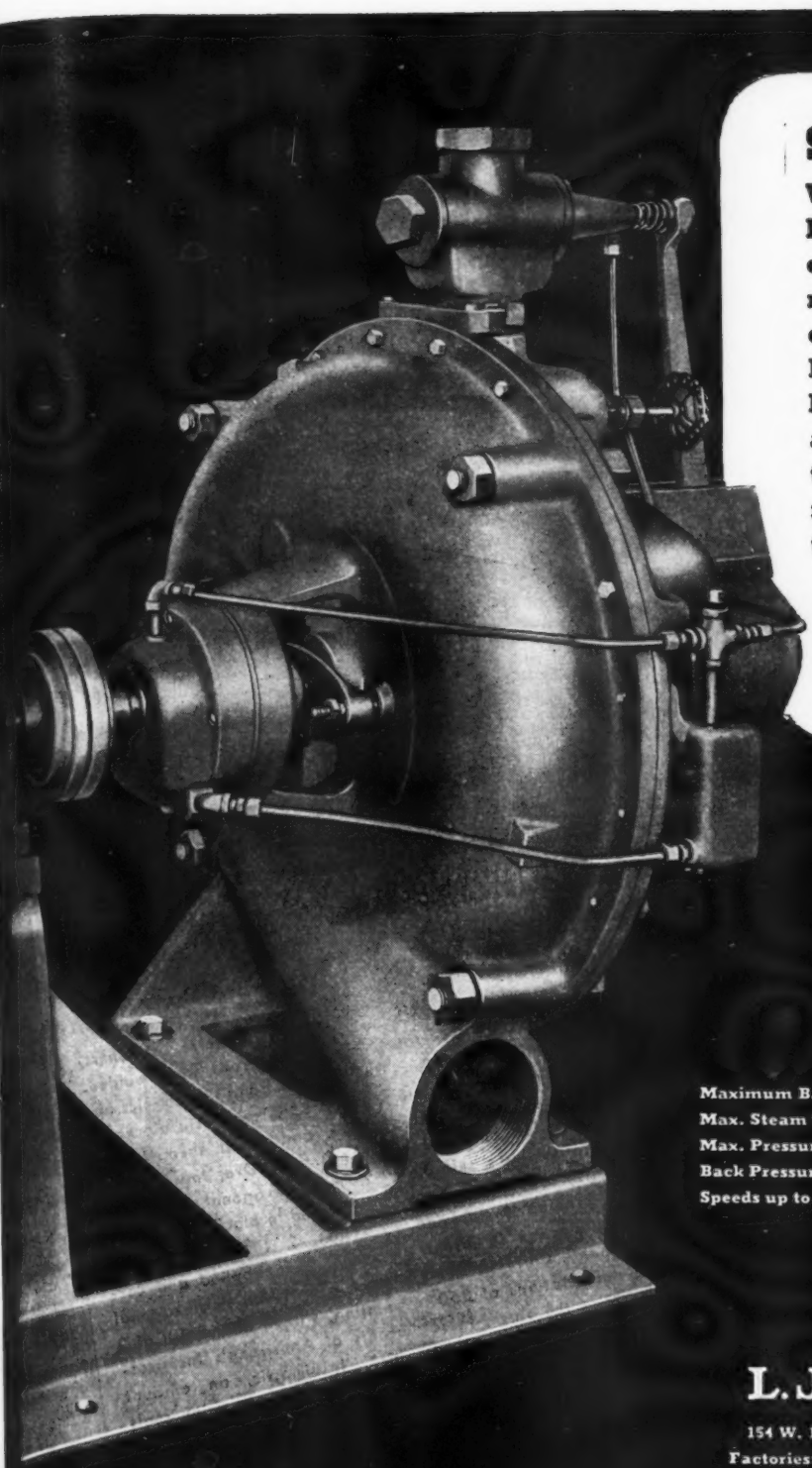
3. Lower upkeep costs are made possible by Fillet Welded Hex Bars. They shed dirt, grease and water. They take much less time to keep clean.

Get a bid from BATES on every job where you need GRATES





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Max. Pressure	275 lbs.	600 lbs.
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Speeds up to	4000 RPM	4000 RPM

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L. J. Wing Mfg. Co.

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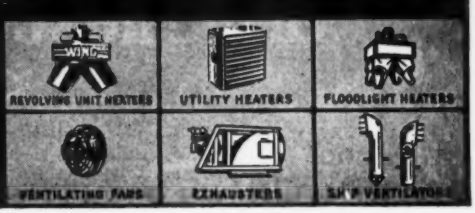

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LONGER LIFE for equipment is one of the important advantages of correctly applied heat insulation. And you can be sure, when the job is done by Armstrong's Contract Service, that it's done right. Armstrong takes entire responsibility for every detail of planning, supervision, materials, and workmanship. You get the full benefit of Armstrong's long engineering experience, materials of tested efficiency, and skilled installation mechanics. For complete details, write today to Armstrong Cork Company, Building Materials Div., 7010 Concord St., Lancaster, Pa.

Custom-tailored overcoats for smoke breechings

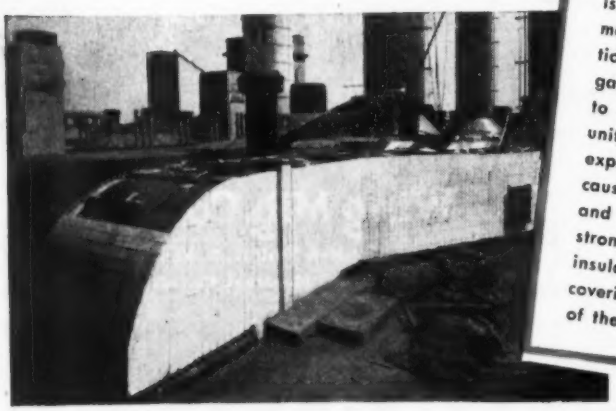
These outdoor smoke breechings of the Delaware Generating Station, Philadelphia Electric Company, Philadelphia, are insulated to prevent condensation and corrosion on the interior and to provide a suitable exterior finish. And the surface is weatherproofed to provide maximum protection to insulation and metal. Carrying spent gases at temperatures of 350° to 400° F. to the stack, these units are subject to unusual expansion conditions. But because it was properly designed and expertly installed by Armstrong's Contract Service, the insulation provides a lasting covering to prolong the life of the metal breechings.

Over transverse stiffeners, ⅛" pencil rods were welded. Then Armstrong's mechanics applied 85% magnesia blocks 1" thick and wired them to the pencil rods. Over these blocks, 2" mesh hexagonal wire netting was wired in place.

Next, 2 coats of asbestos cement were applied and covered with 1" mesh hexagonal netting, with a final finish of 2 coats of Armstrong's Insulmastic*. Insulmastic, an efficient weatherproofing material, seals out air, moisture, and fumes. It cannot crack, blister, or sag.

Expansion joints were insulated and finished in the same way but as separate units, allowing free movement.

* Reg. U. S. Pat. Off.



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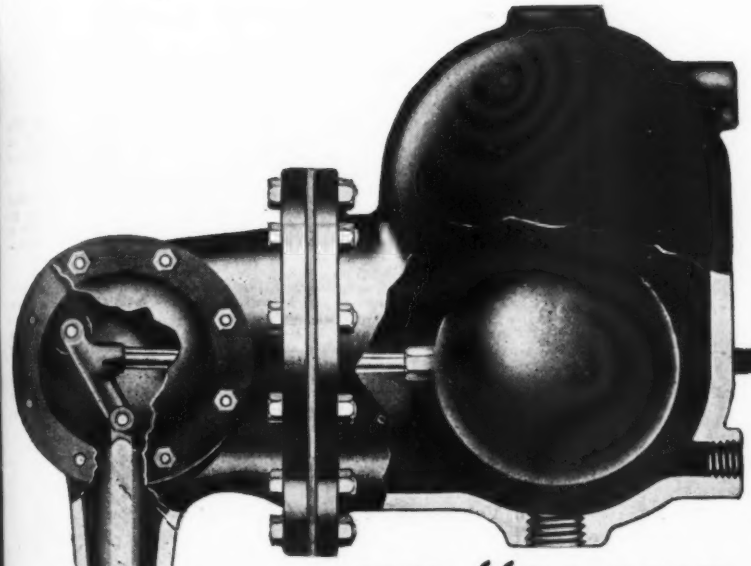

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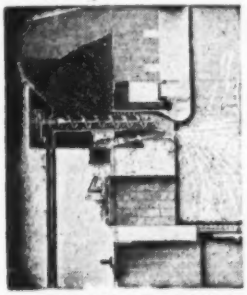

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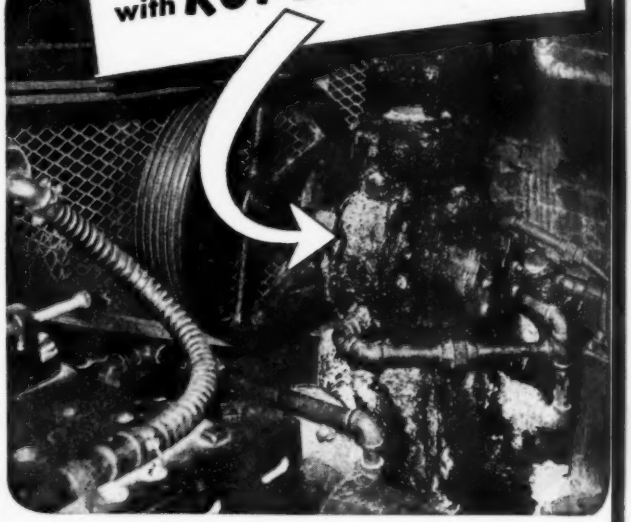

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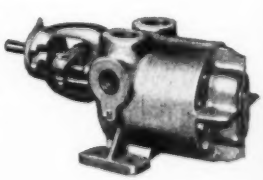

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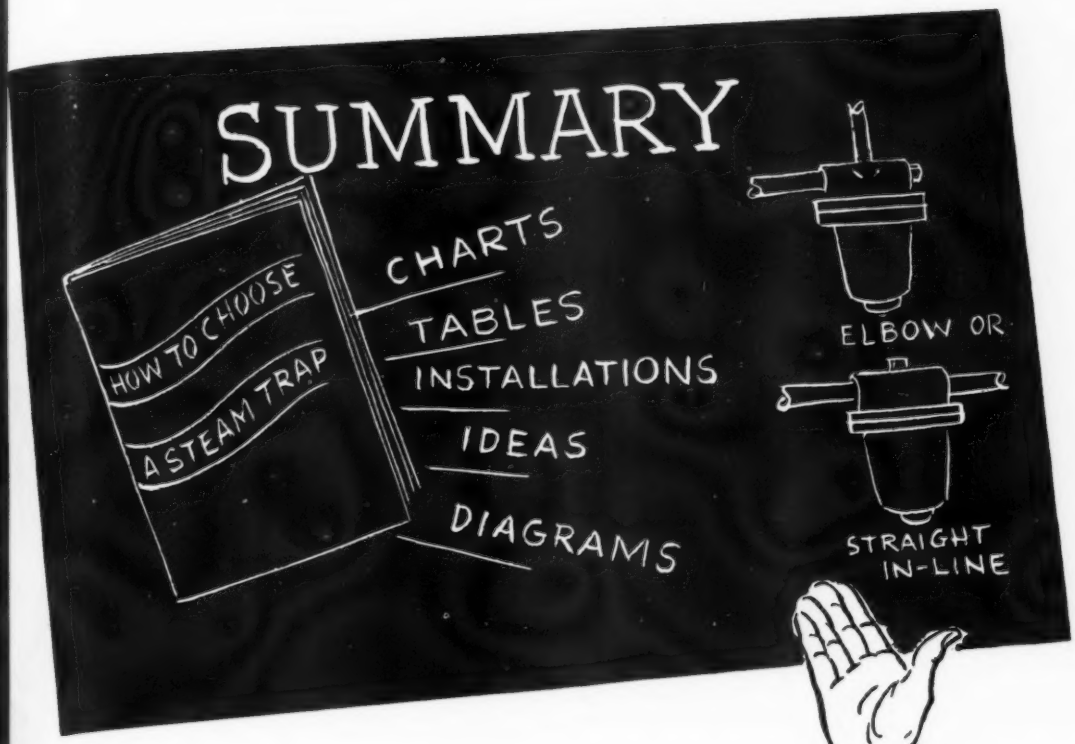

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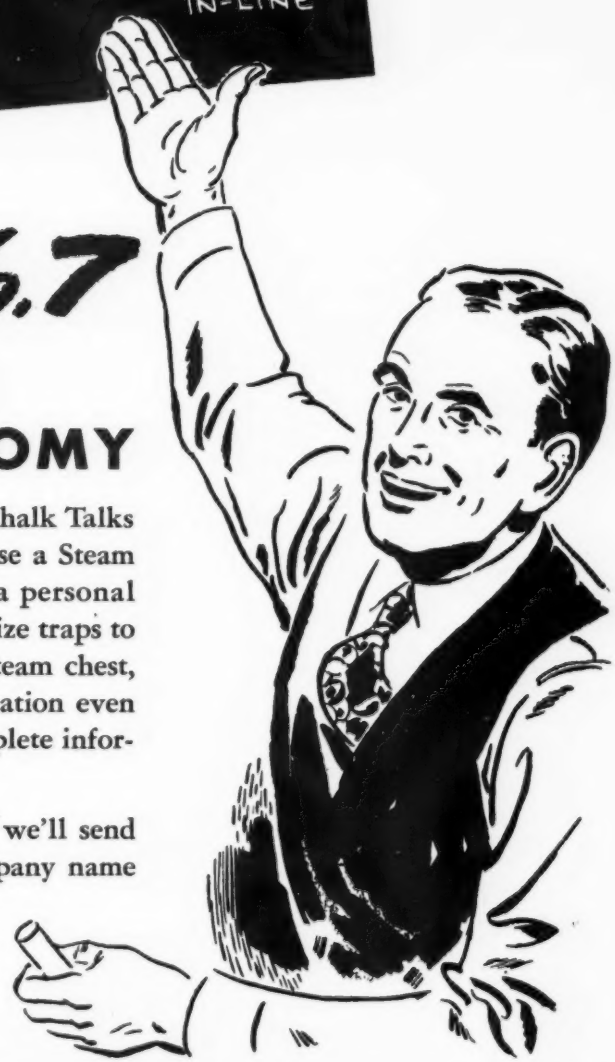

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with this extra-long-taper

RIDGID

● You whisk the burr—and only the burr—from any pipe with easy feather-light ratcheted strokes when you use RIDGID Reamer. No thinning of pipe or conduit wall, no splitting or flaring—because of the extra long taper of this remarkable tool. You save pipe—as well as work and time. Buy it complete with ratchet handle—or if you own a RIDGID 00R threader, it fits the handle; buy the reamer unit only. Ask your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

EXIDE POWER AND DEPENDABILITY

MEET EVERY DIESEL CRANKING NEED

Because of their ability to deliver peak performance under all conditions met in Diesel engine cranking, Exides have long been the battery choice of thousands of power plant engineers and operators of Diesel engines.

The thorough dependability of Exide Batteries in this important task is due to their being designed specifically for the job. As Diesel engineering advanced, Exide engineering kept pace step by step. Thus the extra power and ruggedness of Exides are assurance of dependable performance in all climates, with long-life and ease of maintenance.

Write for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

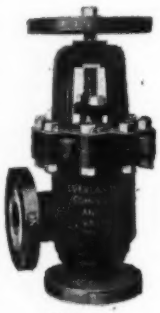
A STURDY *Everlasting valve team* FOR YOUR BOILER BLOW-OFF

Install this EVERLASTING "Duplex" Boiler Blow-off Valve Unit and you'll get PROMPT, DEPENDABLE valve teamwork . . . and no more blow-off troubles!

This is the SEALING Valve

The EVERLASTING Lever-operated Valve (shown on the LEFT of the Unit) provides QUICK opening and closing. An easy, quarter-turn short-stroke movement of the lever assures full-pipe-size opening with straight-through flow . . . or drop-tight closing — *instantly!* And each opening or closing action regrinds the disc on the seat, maintaining the famous Everlasting drop-tight seal.

The EVERLASTING Wheel-operated Angle Valve (on the RIGHT of the Unit) bears the shock of the blow-off force. It supplies enduring resistance to the erosive action of abrasive solids usually present in boiler blow-off water. No pockets anywhere in this valve for the lodgement of solids. A sturdy long-life team—this EVERLASTING Duplex Valve Unit! And it meets all code requirements for your boiler blow-off service. Built with various features, for pressures to 600 lb., sizes 1½" to 2½". Either valve available separately.



This is the BLOWING Valve

Write today for EVERLASTING Bulletin E-100 giving the complete story—no obligation!

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N. J.

Everlasting Valves FOR EVERLASTING PROTECTION

Ingenious New Technical Methods

To Help You With Your Reconversion Problems

"DIE-LESS DUPLICATING" ELIMINATES TIME LOSS AND DIE EXPENSE!

The DI-ACRO Bender is a precision unit, designed to form and duplicate an unlimited variety of parts and pieces—eliminating, in many cases, the need for special dies. Tubing can be accurately formed with the DI-ACRO Bender to a center line radius as small as 2½ times the outside diameter of the tube without distortion. Shapes and outlines, impossible to obtain with regular production dies, are easily formed with the DI-ACRO Bender. These include round, half-round, hexagon, and square rod, tubing, angle, channel, moulding, strip, stock and bus bar.

Typical Shapes Formed by the DI-ACRO Bender

Stops may be set and material guides mounted for production work in excess of 1000 operations per hour. The Bender is compact and portable, ideal for temporary or permanent work. There are no extra parts to purchase, as the DI-ACRO Bender has been built to cover a wide working range, with simple conversions.

Peacetime production forecasts the return of Wrigley's Spearmint Gum—that favorite "help on the job," for workers everywhere. But Wrigley's Spearmint will be back only when conditions permit its manufacture in quality and quantity to meet your needs. Until that day, we ask you to remember the famous Wrigley's Spearmint Wrapper shown at right, as your guarantee of the finest chewing gum that can be made.

Remember This Wrapper

You can get complete information from O'Neil-Irwin Manufacturing Co., Minneapolis 15, Minn.

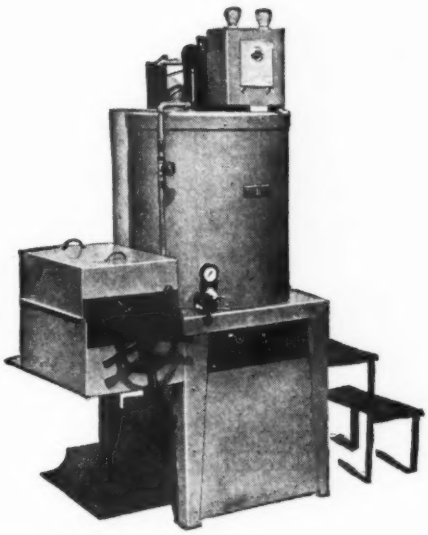
Z-87

HOW MANY GALLONS OF 50¢ OIL CAN YOU BUY FOR *ONE* DOLLAR?

TWO?..... wrong

THREE...OR FOUR OR MORE...RIGHT!

THIS DOES IT



THE YM OIL REFINER

This is one of the new models of the YM Oil Refiner. Units are available in many sizes.

The YM unit is *not* a mere filter— it's a *real oil refiner!*

The YM Refiner removes *all* of these contaminants: fuel dilution; water, even when emulsified; gums, asphaltic materials, "gunk" that's dissolved in the oil itself. It brings acidity down to new oil values.

And it does all these things economically...without any pre-settling or pre-treatment!

With the YM Refiner, you use the same oil over and over again...no need to discard a single quart. And your machinery is safeguarded from the damage that contaminated oil can cause.

Another point: oil refined in the YM unit is outstanding in anti-varnish properties. The YM removes sludge accumulations—prevents their formation. Oil refined in a YM unit is *aged... more stable.*

You can use the YM unit to restore used lubricating oils—cutting and hydraulic oils—transformer oils—Diesel and gasoline engine oils. Users near you can tell you how effectively the YM Oil Refiner has served them.

And we'll be glad to show you how much *you* can save by its use!

THE YOUNGSTOWN MILLER COMPANY

A Subsidiary of

Walter Kidde & Company, Inc.

1019 Kidde Avenue, Belleville 9, N. J.

Save OIL...and you save MACHINERY

with the **YM OIL REFINER**

MAIL THE COUPON FOR FURTHER DETAILS

The Youngstown Miller Company
1019 Kidde Avenue
Belleville 9, New Jersey

Gentlemen:

Please send me further information about the YM Oil Refiner.

Name.....

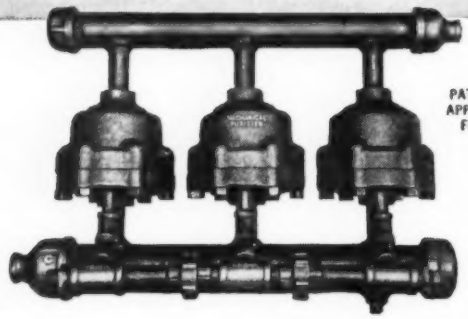
Position.....

Company.....

Street Address.....

City and State.....

Purify Any Pressures, Air or Gas, with Bird-White Multiple Unit *Pur-O-fier*



PATENT APPLIED FOR

Three Models Available

Model A-1 furnished with a 1 inch turbo-rotor and will accommodate volumes from 1 to 8 cubic feet.

Model A-2 has a 2 inch turbo-rotor and can accommodate volumes from 10 to 35 cubic feet.

Model A-4 has a 4 inch turbo-rotor and can accommodate volumes from 35 to 100 cubic feet.

Bird-White multiple unit Pur-O-fiers save time and money by protecting air-operated machines, gauges and controls from contamination. They give positive purification to air or gas lines regardless of fluctuating pressures or high volumes.

The perfectly balanced Turbo-Rotor purifying action makes them sensitive to both regular and intermittent pressures. Write for Bulletin 10 giving complete details.

BIRD-WHITE COMPANY
Dept. PM
3119 W. Lake Street • Chicago 12, Ill.

John Zink
STEAMIZER OIL GUN

It's a fact—John Zink Oil Burners actually perform according to specifications.

1. **Gas or Steam Atomization of fuel oil or sludge.**
2. **Short flame at low excess air.**
3. **Low fuel oil pressure required.**
4. **Vertical or horizontal firing.**
5. **Low steam consumption.**

John Zink Oil Guns burn any properly prepared commercial grade of fuel oil.

Write for bulletin

JOHN ZINK COMPANY
TULSA, OKLAHOMA
342 Madison Ave., New York, N. Y.

J&L SEAMLESS STEEL BOILER TUBES

have forged into them an extra margin of strength, safety and ductility.

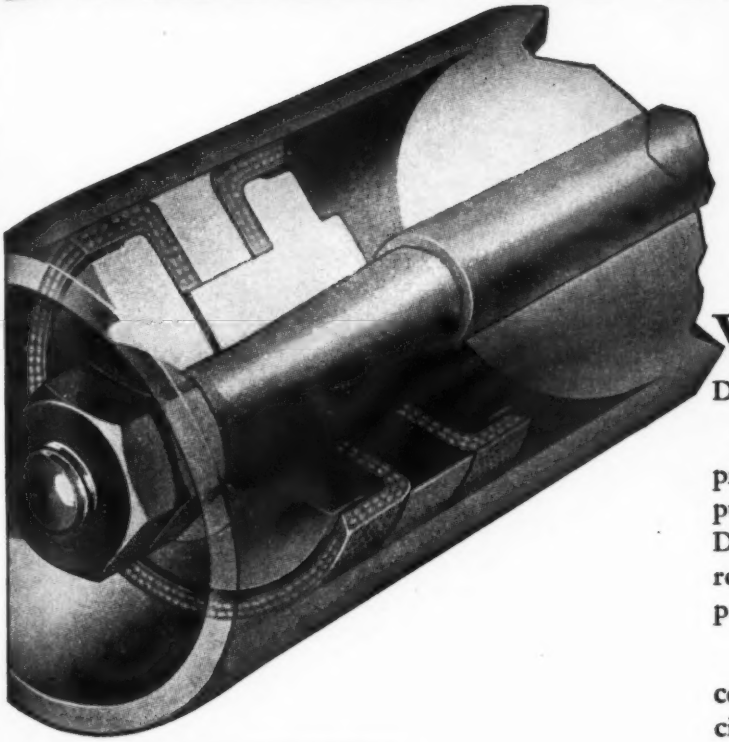
J&L TUBULAR PRODUCTS

SEAMLESS STEEL BOILER TUBES
LARGE O. D. PIPE, WELDED and SEAMLESS
WELDED and SEAMLESS STANDARD PIPE
ELECTRICWELD MECHANICAL and PRESSURE TUBES

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PENNSYLVANIA

DARCOVA PUMCUPS



Unique principle saves up to $100 per pump per year for thousands of pump users

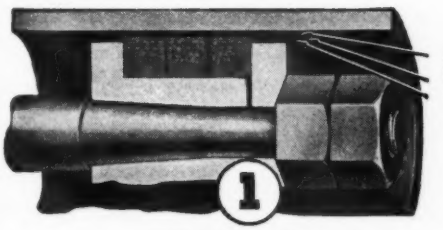
WHATEVER you pump—water, oil, gas, steam, alkalies, acids, or other liquids—Darcova can save you time and save you money.

Darcova is the original composition valve cup, proved by 35 years of service. As applied to pumps, it is known as the Darcova Pumcup. Darcova Pumcups are readily applied to any reciprocating pump by means of a simple, inexpensive adapter piston, illustrated above.

By employing the simple cup principle, Darcova increases pump capacity and pumping efficiency. On the pumping stroke, fluid pressure against the inside of the cup forces the sidewall out against the liner, creating a tight seal that prevents slippage past the piston. This tight seal also prevents lodgment of dirt or abrasive particles between cup and liner, and so reduces scoring and wear.

Just compare this efficient action with that of ordinary pump packing. And remember, too, that Darcova's unique composition stands up—not only against the frictional wear of millions of pump strokes, but against chemical action of all kinds, too.

No wonder thousands of Darcova customers are experiencing up to $100 saving per pump per year.

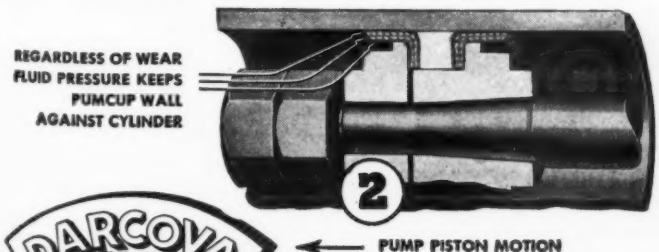


1 THE OLD WAY

From the minute ordinary packing is installed in your pumps, it begins to wear. Each piston stroke means increased clearance between packing and liner. Added clearance means more slippage—and more loss of efficiency—until finally efficiency drops so low that the pump must be repacked. Note also that friction load is the same on both load and return strokes.

2 THE DARCOVA WAY

With Darcova Pumcups, the cup principle insures constant pumping efficiency. Fluid pressure keeps the Pumcup sidewall in close contact with the liner, regardless of wear. There is minimum slippage. Furthermore, on change of stroke, pressure inside the Pumcup is released and load on return stroke reduced. This means fewer shutdowns and many hours of longer service.



Let Us Survey Your Needs, FREE

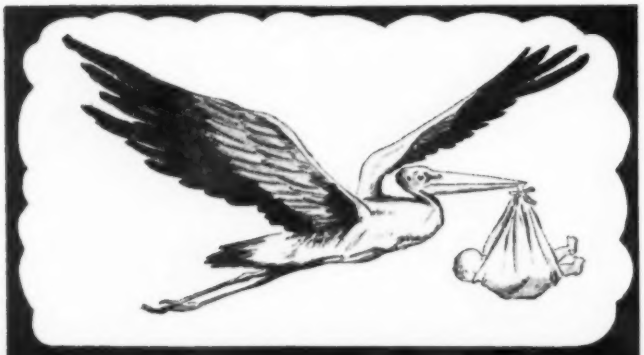
Darcova Field Engineers can help you get more for your pumping dollar—just as they are helping others. Phone, wire or write us about the FREE Darcova Survey Plan and Service.

DARCOVA TRADE MARK

THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.



Management Knows The Facts of Life

Management knows that where there is fire, there must be soot and carbon (fire-scale), regardless of the engineer's experience and ability. Management knows how he removes soot and carbon!

What management does not know—but would appreciate his telling them—is that there is a better way to remove soot and carbon than by the old-fashioned hand-cleaning method.

That better way is the modern, fast, inexpensive chemical method —with NO-KARB Soot Remover. NO-KARB is a reddish-brown granular compound. Scattered over burning coals or in the path of an oil-burner flame, it reacts chemically on soot and carbon to bring their ignition point down to that of fuel. Fire-scale and fuel are then consumed together, ridding engineer and management of a recurring nuisance job. Write for popular folder, "Management Knows The Facts of Life."

DISTRIBUTORS! SALESMEN! A FEW CHOICE TERRITORIES OPEN.

NUTMEG CHEMICAL CO.
223 State Street
New Haven 10, Conn.

CUT COSTS

Weld pipe or tube joints *with* WEDGE *Split* CHILL RINGS

There are many advantages in using WEDGE Chill Rings with the patented SPLIT Feature for welding pipe and tube joints. You get REINFORCED joints that will not leak or break in case of shock, strain or vibration. They will enable you to weld FASTER. Because the joints are reinforced it is possible to use LIGHTER WALLED pipe with safety. WEDGE Chill Rings not only give stronger joints but will cut costs. If you weld joints, write.

Split Feature Patented

Write for circular and prices.

WEDGE PROTECTORS, INC.
9524 Richmond Ave. Cleveland 5, Ohio

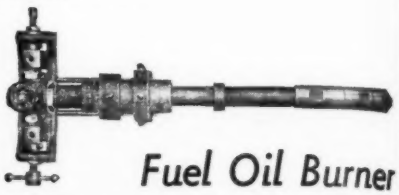
WEDGE CHILL RINGS SAVE MONEY

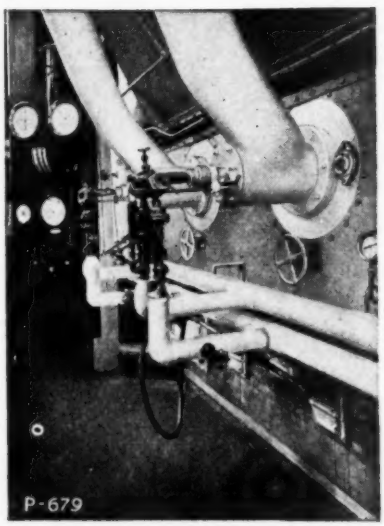
INSTANT CHANGE

FROM FUEL OIL TO POWDERED COAL

with this versatile . . .

S. A. L. *Fuel Oil Burner*





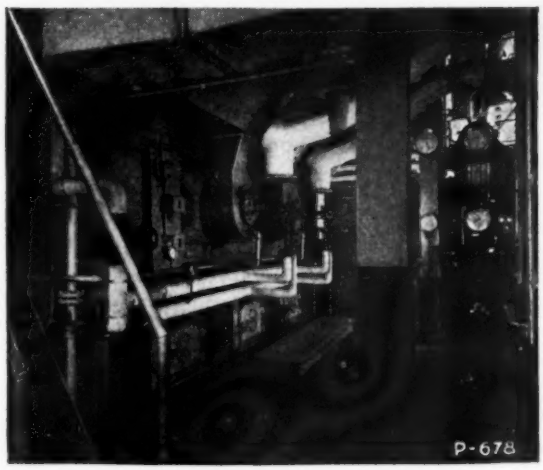
INSTALLED IN BOILERS SHOWN HERE . . . THE NATIONAL AIROIL BURNER . . .

S. A. L.

PERMITS A JIFFY CHANGEOVER FROM FUEL OIL TO POWDERED COAL

AT LEFT: 500 HP. B. & W. Stirling type; Adams combustion controls. Output 60,000 lbs. per hr.

BELOW: 500 HP. B. & W. Stirling type; Bailey combustion controls. Output 50,000 lbs. per hr.



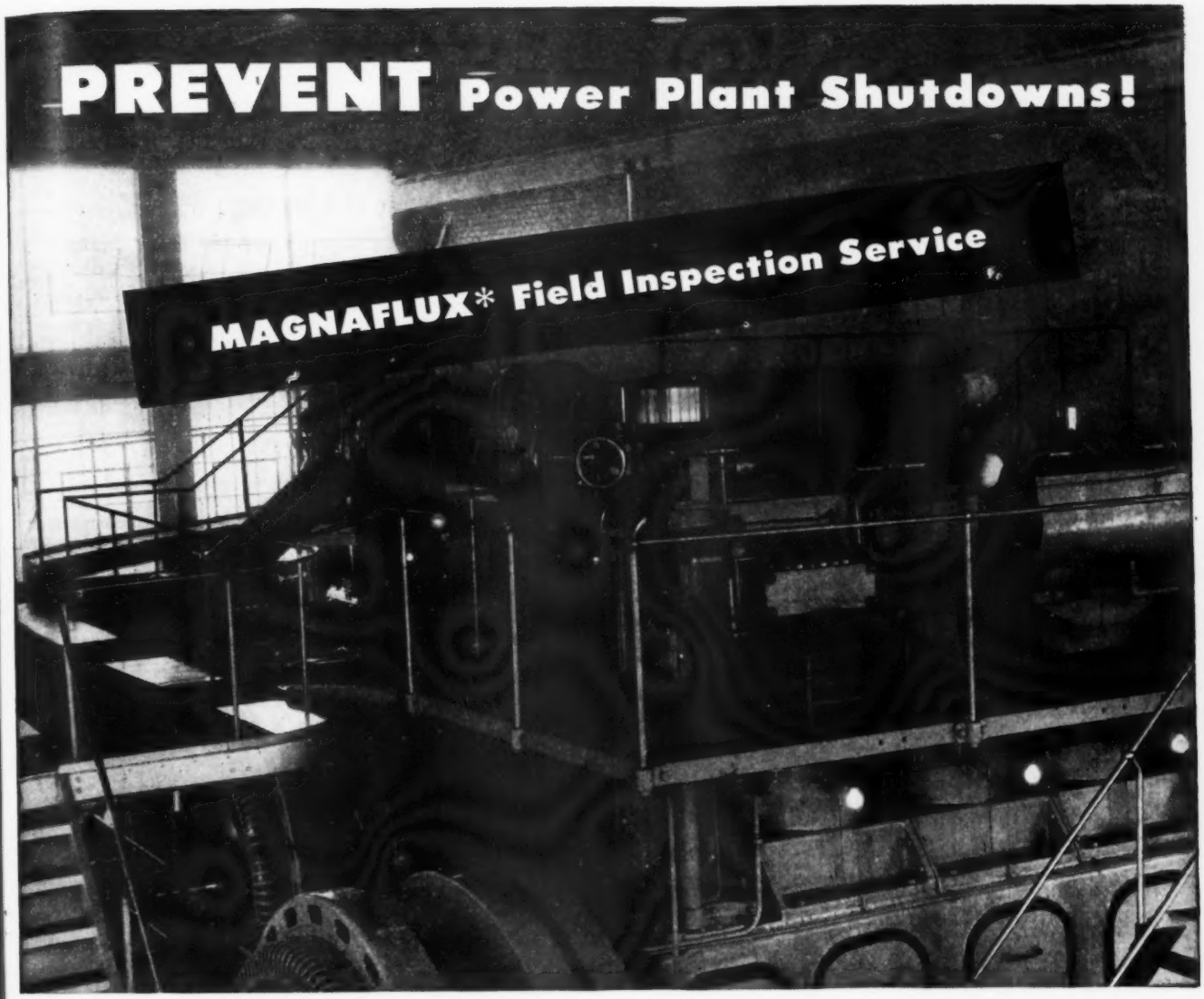
The S. A. L. fuel oil burner is engineered and has been quickly applied to burn fuel oil with all powdered coal systems . . . including Babcock and Wilcox; Combustion Engineering; Strong Scott and Simms Pettibone for capacities up to 650,000 pounds of steam per boiler per hour. Wire for details.

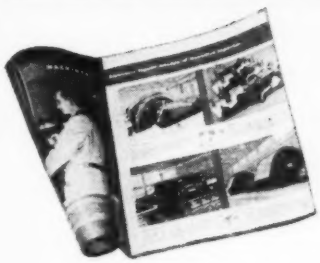
NATIONAL AIR OIL BURNER

COMPANY, INCORPORATED
1250 East Sedgley Avenue
PHILADELPHIA 34, PENNA.

OIL BURNERS • GAS BURNERS • GAS PILOTS • PUMP SETS
EXPLOSION DOORS • ACCESS DOORS • AIR DOORS
BURNER BLOCKS • FURNACE OBSERVATION WINDOWS

PREVENT Power Plant Shutdowns!





Write for This New Illustrated Bulletin . . .

and ask specifically for interesting facts about Magnaflux Field Inspection Service—that detects and protects. Magnaflux Field Service Engineers are conveniently located to serve you quickly

Regular Inspections Help to Avoid Mechanical Failures

Costly shutdowns and accidents caused by fatigue cracks and other *detectable* flaws in diesel engines and other power plant equipment can be foreseen and avoided. A regular check-up on the vital units in your plant is the best assurance of continuous, trouble-free operation.

Magnaflux, and Zyglo, the two elements of MAGNAFLUX FIELD INSPECTION, are applicable to a full range of equipment. Magnaflux inspection service is speedy and non-destructive for complete flaw detection in both magnetic and non-magnetic metals.

Scheduling of Magnaflux service can be arranged to coincide with normal tear-down and overhaul work. It will pay you to investigate the possibilities. Write today for complete information.

**Magnaflux—Zyglo—Registered U. S. Patent Office, trade names of the Magnaflux Corporation applied to its equipment and materials for magnetic particle and fluorescent penetrant inspection.*

MAGNAFLUX CORPORATION

5926 Northwest Highway, Chicago 31, Illinois

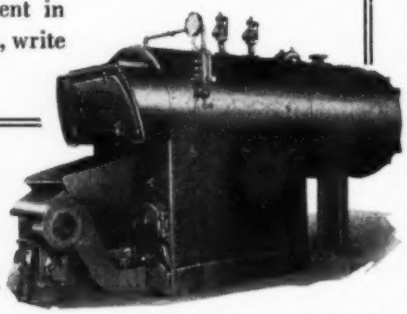
NEW YORK DETROIT DALLAS LOS ANGELES CLEVELAND BIRMINGHAM

THE EVIDENCE IS NEAR YOU

BECAUSE so many Brownell boilers and stokers have been installed during the last 90 years, your local agent can show you Brownell installations in actual service and enable you to secure first-hand evidence from owners. Base your decision upon what you see and hear, but bear in mind that you will obtain the benefit of important improvements in the latest Brownell equipment.

If you do not know the name of the Brownell agent in your vicinity, write us.

THE
Brownell
COMPANY
306 N. Findlay St.
Dayton 1, Ohio

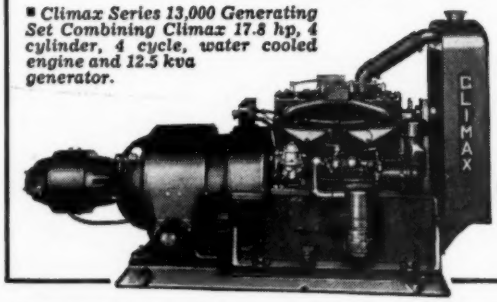


Brownell Boiler and Stoker as a Matched Unit—the Ideal Installation

Unfailing . . . Low Cost POWER and LIGHT

in 5 to 12.5 kva range, AC or DC

■ *Climax Series 13,000 Generating Set Combining Climax 17.8 hp, 4 cylinder, 4 cycle, water cooled engine and 12.5 kva generator.*



CLIMAX SERIES 13,000 Generating Sets

THE DEPENDABLE, smooth, power output and steady, flickerless lighting supplied by these compact, quiet-running units makes them invaluable for railroad, construction and oil field flood lighting — for standby power and light in industrial plants, hospitals, schools, etc.—and for operating medium size radio transmitters and electric magnets.

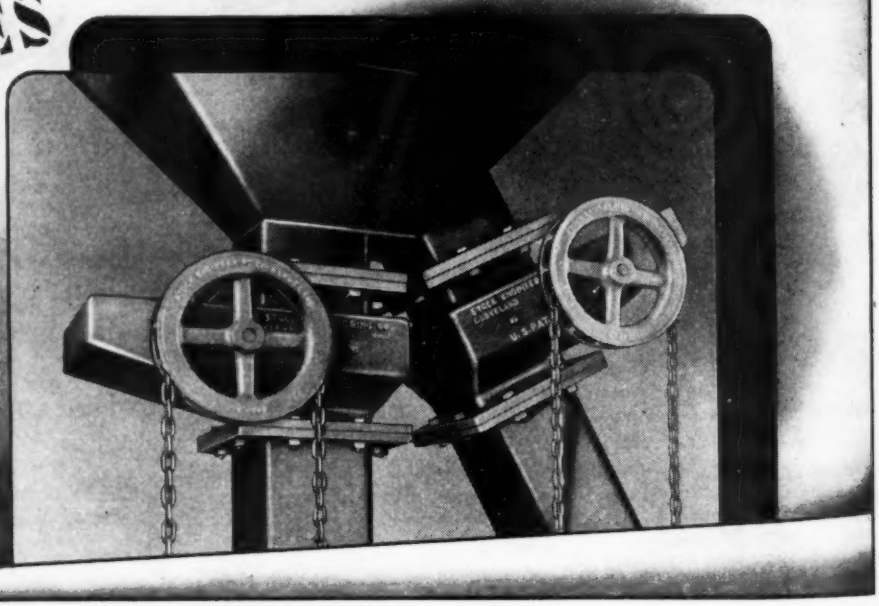
21 Models, 5 to 12.5 kva AC, and 6 to 10 kw DC, available with hand crank, remote control or automatic emergency transfer starting. Equipped for stationary or portable service. Operates on gasoline, natural gas, butane or other fuels.

Average fuel consumption at full load, .20 gals. per kwh—on 1000 BTU natural gas, 25 cu. ft. per kwh.

For bulletin describing all available models, write Climax Engineering Company, Clinton, Iowa. Other Climax Generating Sets from 300 watts to 312 kva.

climax GENERATING SETS
Builder of Climax BLUE STREAK and DIESEL ENGINES
CLIMAX ENGINEERING COMPANY

S. E. Co. SOOT VALVES keep dust where it belongs... inside the valve!



Slides in S. E. Co. Soot and Sifting Valves are self-cleaning. The design of the valve rules out any possibility of soot and dust accumulations, thus there is never any binding. Dust-tight construction is an important part of S. E. Co. Soot Valve design,—another reason for using them in your plant! *Bulletins will be sent on request. Address inquiries to* STOCK ENGINEERING CO., 715 Hanna Bldg., Cleveland 15, Ohio.

STOCK
ENGINEERING CO.

S.E.Co. Coal Valves and Coal Scales, CONICAL Non-Segregating Coal Distributors

RUBEROID INSULATION

A complete service

• **Ruberoid Insulation service gives you every ingredient for insulating success—all in one "package"!**

MEN . . . Ruberoid service includes approved applicators, insulating technicians, available in all principal industrial areas, trained in the use of Ruberoid Materials.

MATERIALS . . . Ruberoid's full line of insulating materials is specifically developed to meet every temperature control problem from 0° to 1900° F.

METHODS . . . Ruberoid provides the best that modern insulating research and technology can offer—the *right* method for every problem, top efficiency at the lowest possible price.

This is the Ruberoid way of insulating —a simple, all-over method that leaves no gaps in completely solving any insulating problem. Ruberoid engineers will welcome the opportunity to tell you more about it.

Write for Ruberoid Insulation Guide and technical data.

The RUBEROID Co., *Executive Offices,* 500 Fifth Avenue, New York 18, N. Y.

ASPHALT AND ASBESTOS BUILDING MATERIALS

Simple, effective repair of a cracked piston head may be made easily with Smooth-On No. 3 Iron Repair Cement, which comes ready to use, in paste form.

To repair a radial crack, remove enough of the metal to receive a carefully fitted plug. Coat recess and plug thoroughly with Smooth-On No. 3 and secure in place with flat-head screws, also seated with Smooth-On.

Smooth-On will seal the cracks and seal the plug completely.

This inexpensive repair is typical of hundreds of jobs Smooth-On Iron Cements have been used for in industrial plants the past 50 years. Repairs on iron, steel, lead, brass, copper and other metals. Always keep Smooth-On handy for both routine and emergency repair jobs. Smooth-On No. 3 comes in 1-, 5-, and 25-lb. sizes. Order from your supply house, or, if necessary, direct from us.

FREE Repair Handbook

Get this 40-page instruction manual, suggesting countless practical, tested, short-cut, economical metal repairs on industrial and home equipment. 170 diagrams. Simplified directions. A pocket size book for every engineer and maintenance man.

Smooth-On Mfg. Co., Dept. 30
570 Communipaw Avenue
Jersey City 4, N. J.

Please send the Repair Handbook

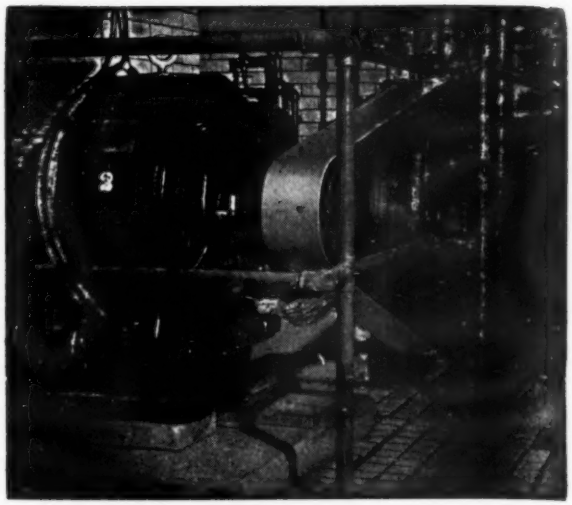
Name .....

Address .....

10-45 .....

Do it with **SMOOTH-ON**
The Iron Repair Cement of 1000 Uses

Specify . . .
RHOADS TANNATE



the LEATHER BELTING
that gives you these advantages—

√ Reliable, Efficient Economical Operation

√ Minimum Maintenance and *Long* Life

LET RHOADS ENGINEERING SERVICE HELP YOU PLAN—

Rhoads Engineering Service, based on long specialization in the manufacture and application of leather belting, has helped many firms secure real savings through increased efficiency of their drives. We can help you too in planning a new drive or changing an old one.

Tannate-Rockwood drives have proved their exceptional reliability during recent years in maximum production through controlled belt tension. Tannate belts have unusual grip. They resist moisture, machine oils and many chemicals. Little maintenance is required to assure long life.

Write for our helpful pamphlet—"Better Service Belt Hints"

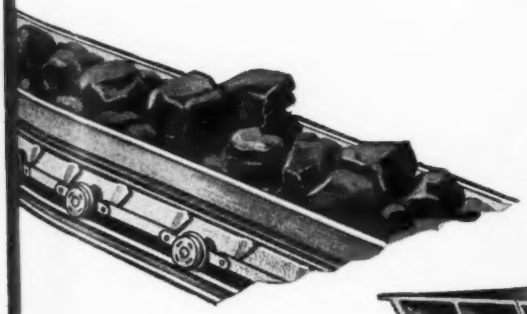
Rhoads
Tannate
WATERSHED
LEATHER BELTING

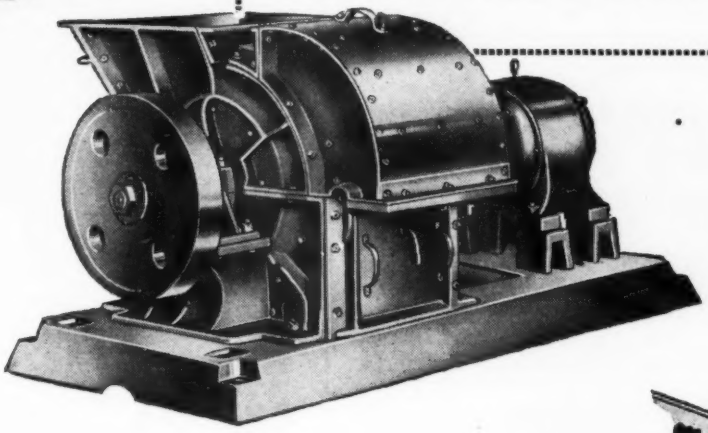
J. E. RHOADS & SONS • Est. 1702
35 N. SIXTH ST., PHILA. 6, PA.

NEW YORK • CHICAGO • ATLANTA

AMERICAN SHREDDER RINGS SPLIT—INSTEAD OF CRUSHING—COAL TO UNIFORM SIZES

for stoker firing and pulverizer feeding





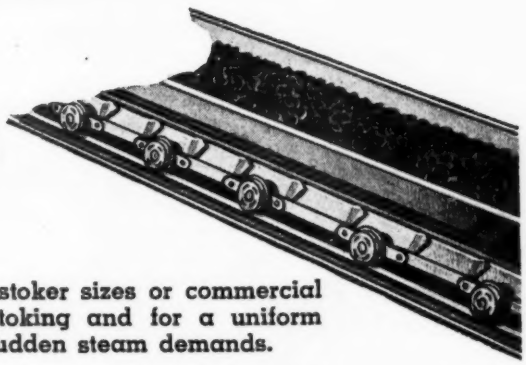
American Type "S" Rolling Ring Crusher

COAL IS SPLIT · NOT CRUSHED

The manganese shredder rings, employed exclusively by Americans, each have 20 cutting edges which split coal by terrific centrifugal force. This is the American feature that provides a uniform crushed product.

The shredder rings revolve freely on their own shafts and when contacting tramp metal, they deflect undamaged. No shear pins or conventional safety devices to bother with.

Send for American "S" Bulletin for data on crushing coal for combustion efficiency



NO OVERSIZE AND COMPLETE CONTROL OF FINES TO MINIMUM OR MAXIMUM . . . . .

ROM or lump is rapidly reduced to stoker sizes or commercial screenings *uniformly*—for efficient stoking and for a uniform fire bed which quickly responds to sudden steam demands.

The American Type "S" is custom-built in 9 different sizes—in capacities from 25 to 500 TPH. Its sturdy construction and fine operating features assure long life and minimum maintenance under hard continuous usage.

The operating cost of American Crushers is unusually low—*less than 1¢ per ton.*

Power demands for Americans are minimized through their dynamically balanced rotors and through their *double use of centrifugal force.*

Americans are built by makers of crushers exclusively.

Ask any of the many who operate Americans—*all over the world!*

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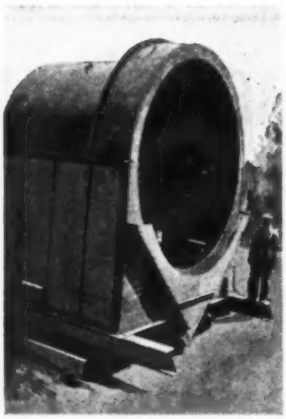
. . . one of five units built for Penn-Dixie Cement Corp. at Plant Four, Nazareth, Pa.



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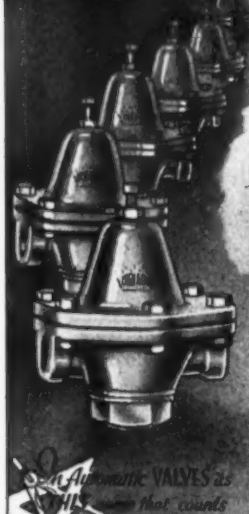

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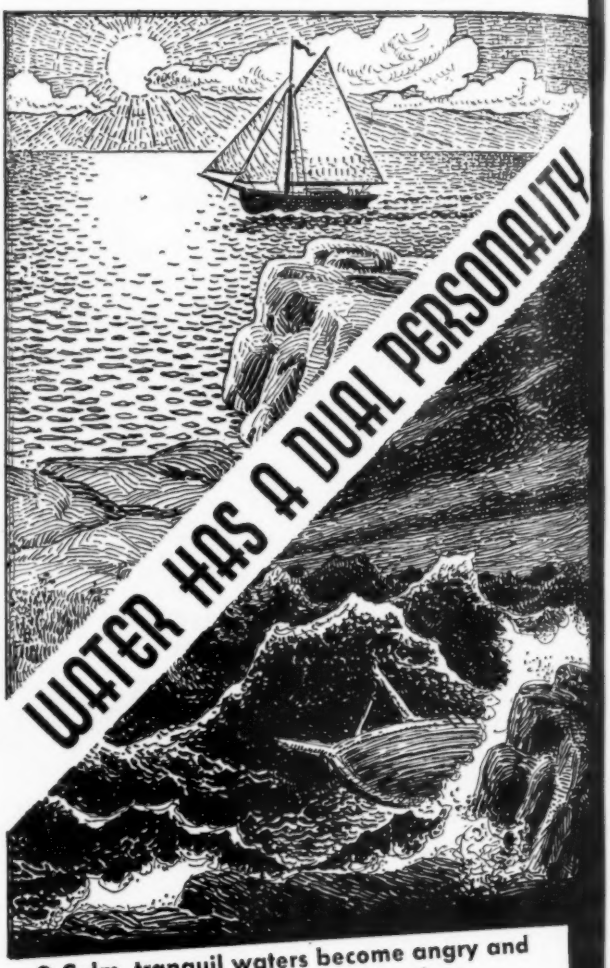

● Calm tranquil waters become angry and turbulent—*visible* changes take place.

● *Hidden* chemical changes take place from day to day. These are not perceptible to the human eye—but they have great bearings on the operation of your boiler.

● In view of constant chemical reactions in the water and variable plant operations, proper feedwater conditioning requires a continuous system of control.

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● Our continuous system of control, through regular examinations made at your plant, enables us to detect chemical reactions in the water and to allow for adjustments in boiler operation. This assures maximum boiler efficiency at all times.

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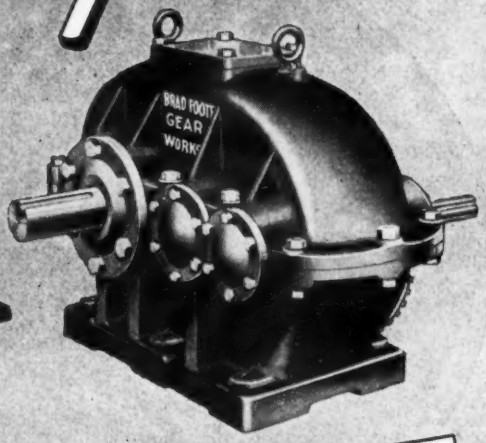
Brad Foote Gears

Worm Gear
3⅝:1 to 60:1

Helical Gear Vertical
2:1 to 80:1



Herringbone Gear
2:1 to 295:1

Speed Reducers

2:1 to 30,000:1

Brad Foote Speed Reducers made in all practical ratios employing every tooth form including bevels and spiral bevels have an exceedingly long record for continuous economical performance. All horse powers are available in this group of Brad Foote products—and all gears, shafts and parts are up to Brad Foote precision standards.

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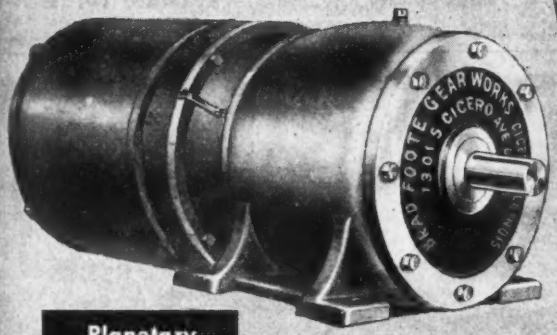
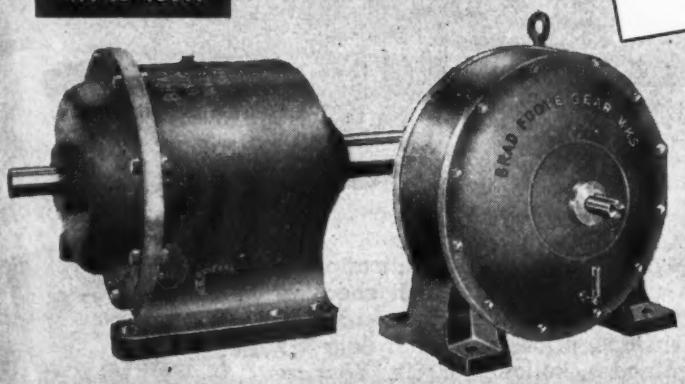
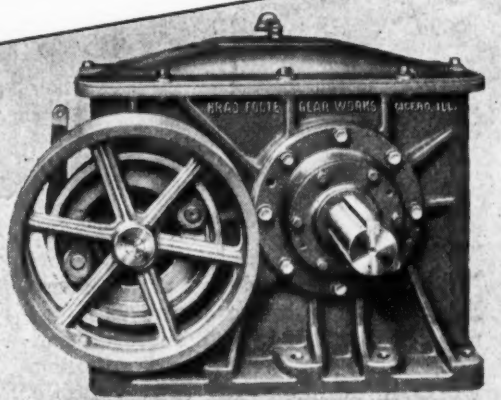


Planetary
4:1 to 400:1



Gyro
16:1 to 30,000:1

Spur
2:1 to 40:1



Oil Well Unit Little Giant
28:1

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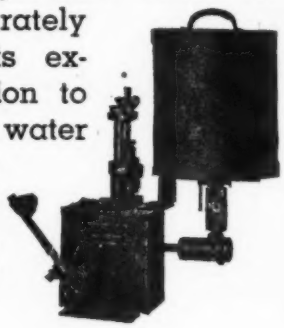

Write for Bulletin.

MANZEL BROTHERS COMPANY
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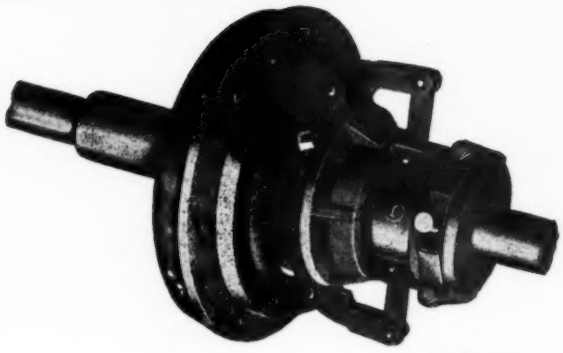
JONES-LEMLEY FRICTION CLUTCHES



JONES-LEMLEY friction clutches are built for a broad range of shaft sizes and ratings in both enclosed and open types for sleeve and coupling work. In addition they are available in a line of Jones-Lemley friction clutch pulleys. This clutch modification is also used for gears, V-belt sheaves, sprocket wheels, etc. Sizes, ratings, dimensions, prices and other data are contained in Bulletin No. 60. Your request will bring a copy.

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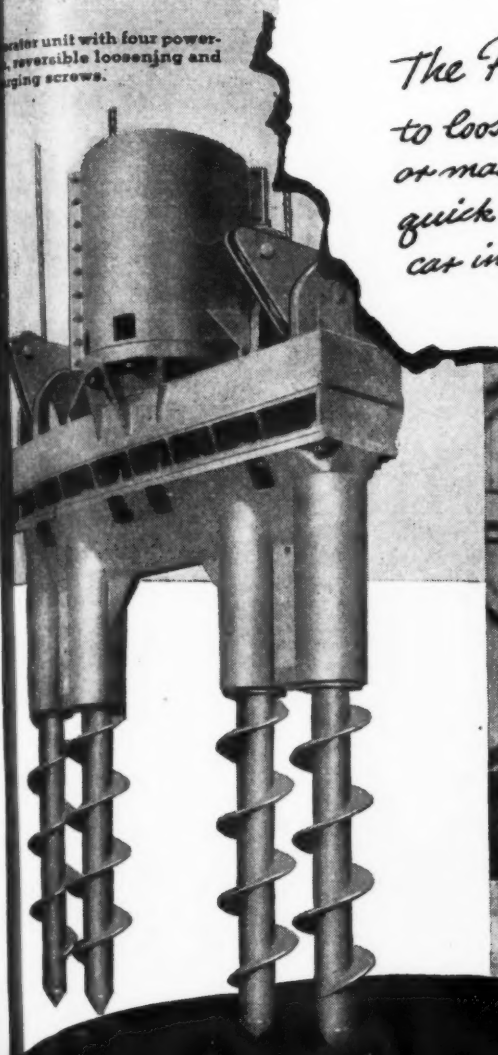
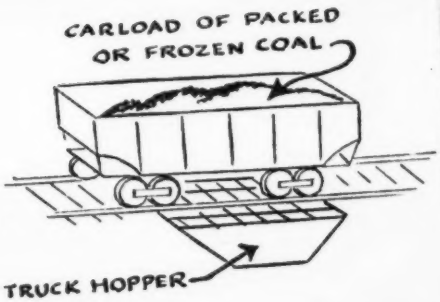
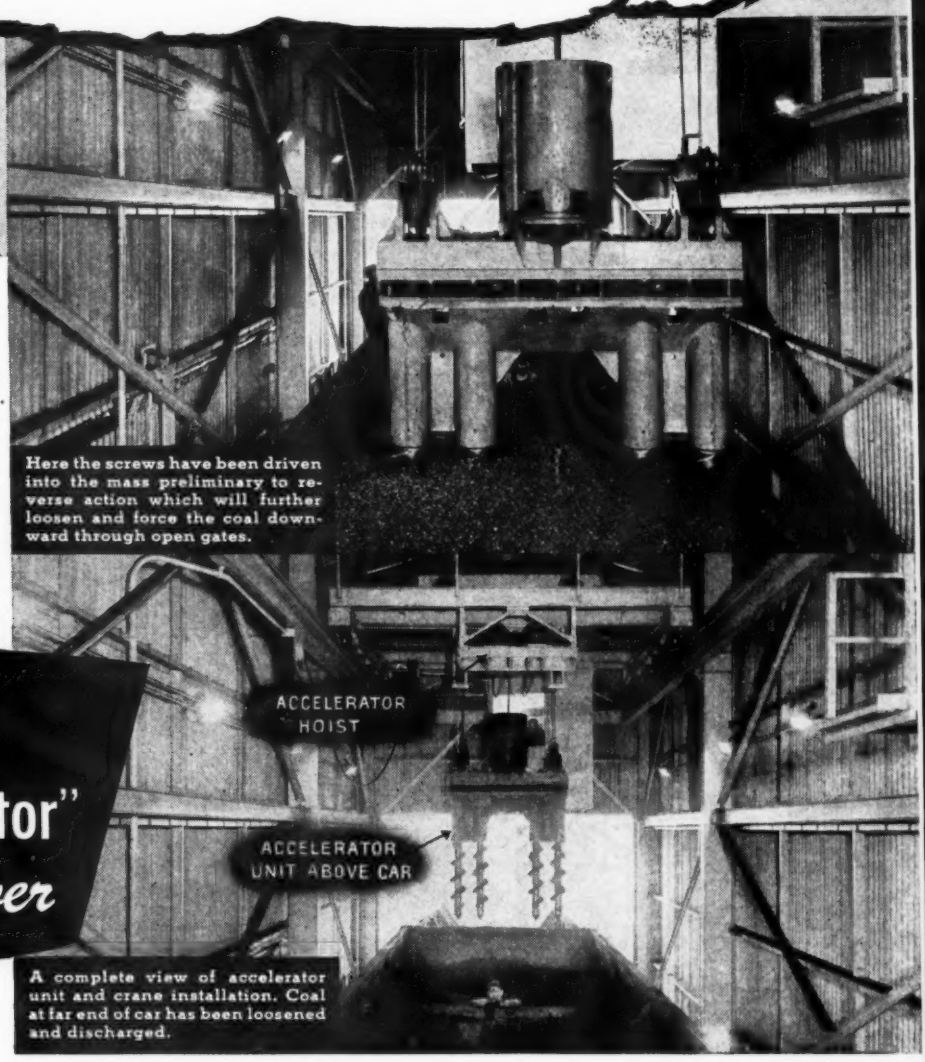


erator unit with four power-, reversible loosening and rging screws.

The Problem — to loosen moisture-packed or mass-frozen coal for quick discharge from dump car into receiving hopper





Here the screws have been driven into the mass preliminary to reverse action which will further loosen and force the coal downward through open gates.

A complete view of accelerator unit and crane installation. Coal at far end of car has been loosened and discharged.

A "Material Accelerator" Supplies the Answer

Time and labor costs of car unloading were halved at one major power plant when S-A engineers recommended and installed an S-A Coal Accelerator.

This remarkable S-A unit consists of four power-driven, reversible broad-bladed screws operated from an overhead traveling crane.

When packed or mass-frozen coal is encountered, the blades of the unit are screwed into it to their full depth. This action loosens the coal and when the rotation of the screws is reversed the coal is forced downward through the open gates of the car. The overhead crane permits spotting the unit over any section of the car where trouble is encountered.

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THE Atomic Bomb landed on American industry long before it devastated Hiroshima and Nagasaki. Maybe it hit you harder than it hit us. All we know is that here at Taylor Instrument, it had an impact not only on our own organization, but on our suppliers and our customers. Here is what happened:

On a spring day in 1943, the War Department called us in to ask us if we would assume the responsibilities of prime contractor on process control instrumentation for the Kellex Corporation for a secret project called the "Manhattan District." As everybody knows now, this was the Oak Ridge Atomic Bomb Project.

We were already supplying instruments to eleven major branches of the armed forces. Commitments to the super-critical synthetic rubber, 100-octane gasoline and chemical industries programs imposed heavy responsibilites. On top of this, war industries' needs were increasing. Materials were scarce and manpower scarcer. But we were told this was an opportunity to help shorten the war. So of course there could be but one answer.

Our responsibilities included the development, design and production — in unprecedented quantities — of a score of new types of instruments, involving new principles, and closer operating tolerances than had ever before been required of process control instruments. In addition, we were asked to loan a number of our top engineers and technicians to the project.

Our production schedules had to be overhauled. Directives over-rode high-rated war orders. Civilian orders stood at the far end of the line. But the problems were solved, because thousands of people in our plants and in those of our subcontractors devoted their whole time to the project to the extent of seven days a week, month after month.

Naturally, we're proud of the way our organization came through. But we're proud too of our many, many customers who showed patience and understanding in the face of temporary delays in delivery for which we could only offer phoney-sounding excuses. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Taylor Instruments mean "Accuracy First."*

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• The Edge Moor Vertical Flow Boiler is adaptable to all methods of firing both solid and liquid fuels. It is available in sizes from the smallest to units capable of generating 200,000 lbs of steam per hour.

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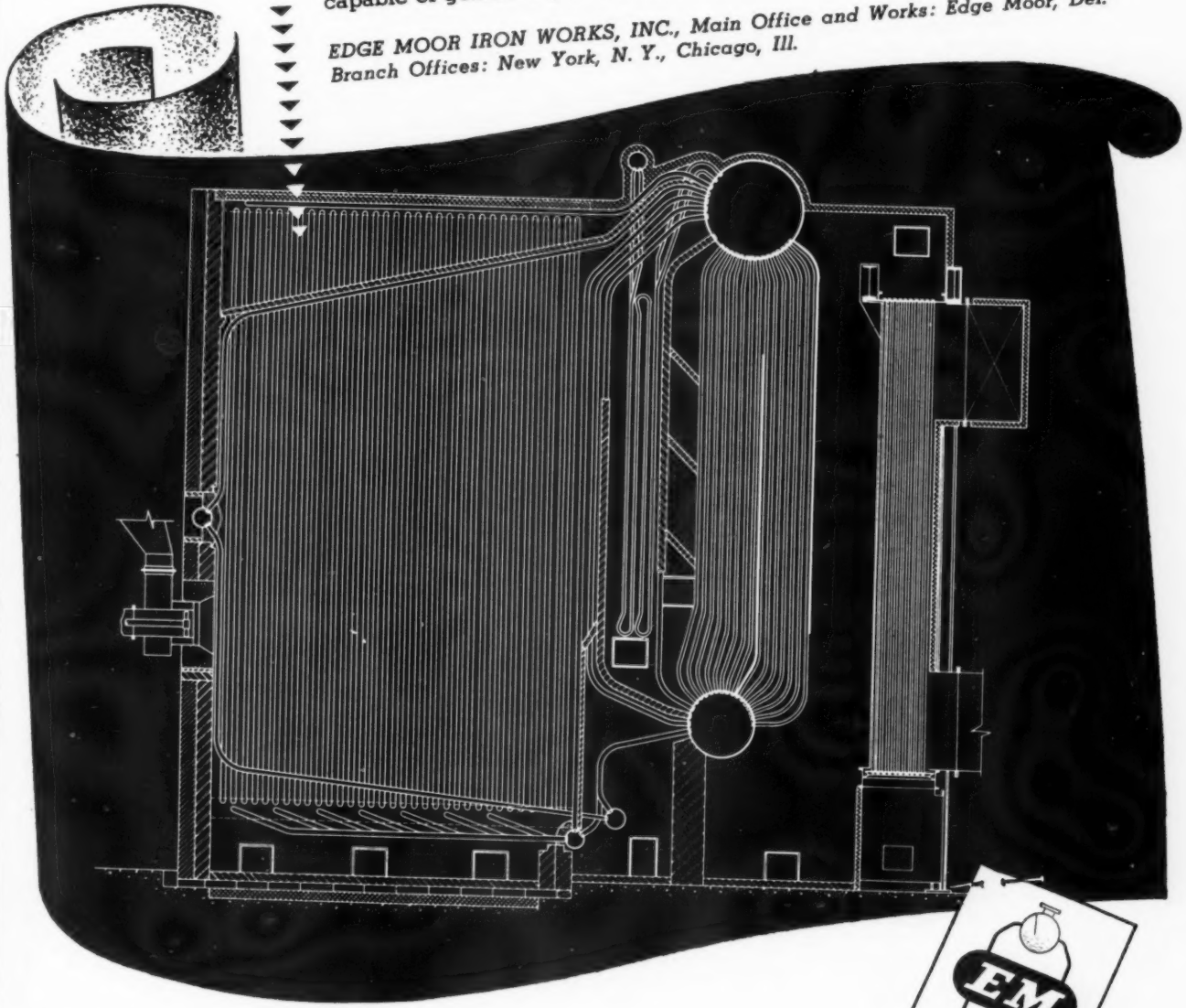
Edge Moor Vertical Flow Unit with Edge Moor Superheater and tubular Air Preheater; arranged for pulverized coal firing.



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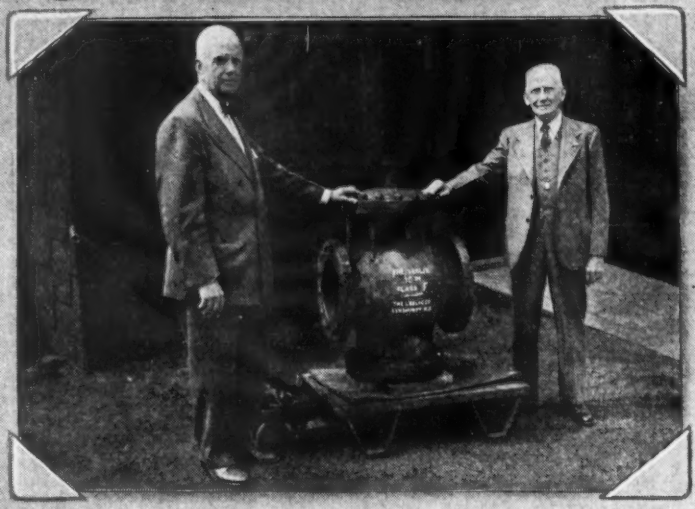
3 "OLD TIMERS"



S. Inglis Leslie, President, and R. J. (Bob) McIlwain, oldest employee and foundry consultant, inspect 35-year old veteran LESLIE Reducing Valve.

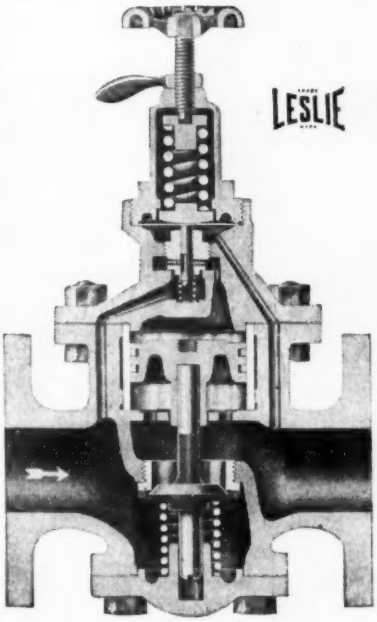
The above illustration marks three separate yet closely related records of service, each indicative of long-term LESLIE quality and reliability.

For, the recent arrival of a 10 in. LESLIE Class F Reducing Valve back for its first repairs after 35 years of hard service, likewise marked 40 years of service with LESLIE CO. of two men closely identified with long-life records of LESLIE Products.

This Reducing Valve, used for controlling steam to reciprocating engines, needed only minor repairs. Following that, it was again returned to the same service, after receiving (and successfully standing) the same rigid maximum steam pressure and operating tests which it underwent prior to shipment 35 years ago—ample indication of a quality that has kept abreast of the best in materials for regulator manufacturing and performance.

To borrow the words of one user, "These Reducing Valves give unbelievable satisfaction. Their constant reliable performance will please any engineer. They are as reliable as the setting sun."

SEND FOR your copy of Bulletin 401-A giving latest engineering data on Pressure Reducing Valves for steam and air service.



Class L-3 LESLIE Pressure Reducing Valve, Self-contained, Spring loaded, internal pilot, piston operated.

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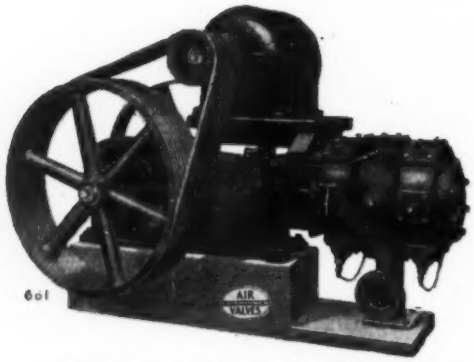

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Overhead mounting of motor for multiple V-belt drive provides compact, space saving installation.

Descriptive bulletin 194 on request

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Mercoid hermetically sealed mercury switches are the most dependable means for opening and closing an electrical circuit. They cannot be affected by dust, dirt, moisture or corrosion; nor are they subject to open arcing, pitting, oxidation or sticking of contacts.

Mercoid Switches are successfully used in many industrial applications.

There are various types available. The magnetic type, illustrated above, operates with the movement of the magnet—the tube remains stationary. The tilting type, opens and closes the circuit on a snap-action principle. Both types provide an instantaneous and positive "make" and "break" in the circuit.

Our engineering staff will assist in their application to any of your switch problems.

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Senior Engineer, Engineering Division, The Detroit Edison Company

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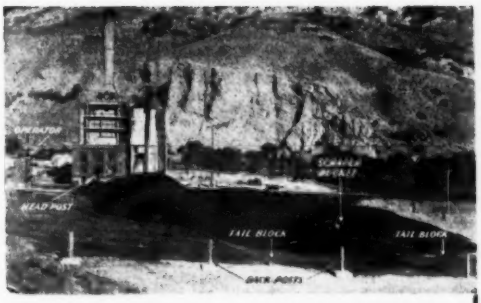


Above is a small Sauerman Scraper System arranged for hand shifting of tail blocks. The picture was taken soon after machine was installed and accordingly shows only the start of the stockpile which eventually covered the entire storage area to a height of 15 ft. and contained about 25,000 tons of coal.

IT WILL PAY YOU to investigate Sauerman Power Drag Scraper Systems for storing and reclaiming coal.

You can save labor for these systems move coal to and from any point in the storage area under virtual "push-button" control of a single operator.

You can save space for a Sauerman machine stores maximum tonnage on any available area.

You can avoid unnecessary hazards for a Sauerman machine builds a pile that is homogeneous, compact and safe.

You can save money for users' records show average maintenance costs of only a fraction of a cent per ton of coal handled. Installation cost is surprisingly small.

At hundreds of plants Sauerman Systems are doing a better, safer, cleaner job of storing and reclaiming coal. They can serve you equally well.

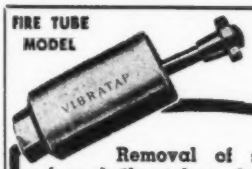
SAUERMAN ADVANTAGES:

- One-man operation
- Maximum use of space
- Greater safety
- Low-cost equipment
- Upkeep simple
- Adjustable range.

Our Catalog is yours for the asking

SAUERMAN BROS., Inc.
562 CLINTON ST., CHICAGO 7, ILL.

FIRE TUBE MODEL



SAVE COAL

Removal of scale from boiler tubes always saves coal. Use a VIBRATAP TUBE CLEANER for a thorough removal of incrustation. Write for Bulletin V-20.

BRUNT EQUIPMENT CO.
60 S. DIVISION ST. · BUFFALO, N. Y.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

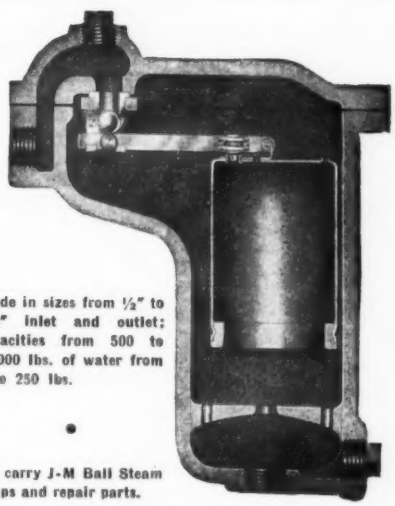
POWERS TEMPERATURE HUMIDITY and HUMIDITY CONTROL

Automatic Control

For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2771 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

WHERE DEPENDABILITY COUNTS
—You can count on CRYER!
"All's Well with CRYER TRAPS"



Made in sizes from ½" to 2½" inlet and outlet; capacities from 500 to 38,000 lbs. of water from 1 to 250 lbs.

We carry J-M Ball Steam Traps and repair parts.

Reconversion is here. Let Cryer help you with your steam line problems.

Cryer Bucket Type Steam Traps offer these outstanding features:

- . . . **non-binding:** all air being discharged before condensate through valve at top.
- . . **positive-acting:** a free turning ball valve providing correct seating.
- . . . **quick-venting:** air being discharged rapidly, through mechanically controlled valve regardless of temperature.
- . . . **readily accessible and easily cleaned.** Cover plate and all mechanism may be removed without disconnecting any piping.
- . . . **ample capacity for the job.**

CRYER TRAP AND VALVE CO., INC.
Manufacturers of Steam Specialties for over 40 years.
366 MADISON AVE. NEW YORK 17, N. Y.

SYNTRON

"Pulsating Magnet"

ELECTRIC VIBRATORS

Make STUBBORN, WET COAL FLOW FREELY THRU BINS, HOPPERS & CHUTES

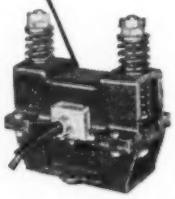
Increase the efficiency of your coal handling system.

What we should know about your problem:—

1. Thickness or gauge of bin, hopper or chute walls.

2. Rough dimensional sketch.

3. Wt. per cu. ft., moisture content, etc. of material handled.



Write to

SYNTRON CO.

492 Lexington

Homer City, Pa.

HONOR THE MEN WHO WEAR THIS EMBLEM

IT STANDS FOR HONORABLE SERVICE TO OUR COUNTRY

SEARCHLIGHT SECTION

Additional Searchlight Adv on pages 373-392

WANTED

ASSISTANT TO CHIEF ENGINEER

To take complete charge of our Power Plant supervising the operation and maintenance of high pressure boilers, turbines, and auxiliary equipment. Young man with both technical and practical background preferred. Excellent opportunity for growth in responsibilities. Give complete personal and business history in letter of application.

FORT HOWARD PAPER COMPANY

Green Bay, Wisconsin

WANTED

Designers and Draftsman

Men who can layout or detail mechanical work. Experience in power & chemical plants preferred but all applicants will be considered. Permanent work with excellent opportunity.

Wyandotte Chemicals Corp.

WYANDOTTE, MICH.

WANTED

Supervisor qualified to take charge of Maintenance and Installation of Instruments in a large chemical plant located in the Middle West.

Must have experience in power plant boiler and combustion control equipment; flow meters; temperature, pressure and level control; recording and indicating instruments, electrically, air and hydraulic operated. General line of automatic batching and weighing equipment. Capable of handling personal problems in the department.

Permanent position with long established company.

P-903, Power
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

Graduate Mechanical Engineer

With experience covering Studies, Reports and Design of Steam Power Plants, by established Engineering Firm.

P888, Power
330 West 42nd St., New York 18, N. Y.

POWER ENGINEERS

Engineers for field service starting up new boilers and auxiliary equipment for large manufacturer. Must be technical graduate or have good background of operating experience with pulverized fuel. Salary to start $200. to $400. per month depending upon qualifications. PLaza 9-6218 in New York City or

P-925, Power
330 West 42nd St., New York 18, N. Y.

(Additional Position Vacant ads on opposite page)

SEARCHLIGHT SECTION

(Additional Searchlight ads on pages 372, 374-392)

WANTED

MECHANICAL DESIGNERS

Experienced in power, industrial, and processing plants. Location, New York City.

EBASCO SERVICES INC.

2 Rector St. N.Y.C. 6

POSITIONS VACANT

DESIGN ENGINEER—An unusual opportunity with large internationally known manufacturer of Air Conditioning and Refrigeration equipment for capable design engineer of refrigeration compressors and condensing units to work as assistant to chief. All replies will be confidential. Please outline qualifications. P-882, Power, 330 W. 42nd St., New York 18, N. Y.

RESEARCH ENGINEER—Unusual opportunity for capable engineer experienced in design and research work of air conditioning and refrigeration equipment to operate new modern laboratory for internationally known manufacturer of Air Conditioning and Refrigeration equipment. All replies will be confidential. Please give outline of qualifications. P-883, Power, 330 W. 42nd St., New York 18, N. Y.

CHIEF DRAFTSMAN with mechanical design background. Experience with hydraulic machinery or pumps desirable. Permanent position with long established pump manufacturer. Salary open. Dean Brothers Pumps, Inc., Indianapolis 7, Indiana.

DESIGNERS, DRAFTSMEN, piping and equipment post-war steam-electric plants. Chicago location. Laramore and Douglas, Inc., 327 S. LaSalle St., Chicago 4, Ill.

CONTRACT MANAGER—Preferably graduate engineer, to assume complete management of Midwestern pipe covering operation. Knowledge of pipe covering sales, estimating, job organiation and supervision essential. Excellent opportunity with old established company. Please write fully. P-907, Power, 620 N. Michigan Ave., Chicago 11, Ill.

CHIEF ENGINEER: For large industrial plant in Milwaukee County. Must be experienced with boilers, electric generators, refrigerating machines, etc. Must be sober and attentive to duties. P-908, Power, 520 N. Michigan Ave., Chicago 11, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. Reconversion is creating lifetime opportunities now. This thoroughly organized confidential service of 35 years' recognied standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 370 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

MECHANICAL ENGINEER, now employed, excellent references, extensive executive power plant operating experince, good rcord in handling personnel, experienced in heat balances and effecting economics, desires position preferably with concern operating several power plants. PW-875, Power, 330 W. 42nd St., New York 18, N. Y.

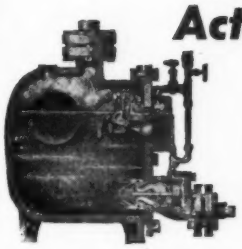
POWER OPERATING Engineer versed in the generation and distribution of steam, electricity, compressed air and water; also specifications, design, construction, plant maintenance and operating costs. Desires association with a midwestern industry as supervisor of power. PW-909, Power, 520 N. Michigan Ave., Chicago 11, Ill.

DIESEL POWER plant prefered. Six years experience with operation and maintenance of high speed marine diesel engines ranging from 1500 to 2000 H.P. Have knowledge of auxiliary machinery. Factory training with Fairbanks and Morse opposed piston engines; also Woodward governors. PW-910, Power, 520 N. Michigan Ave., Chicago 11, Ill.

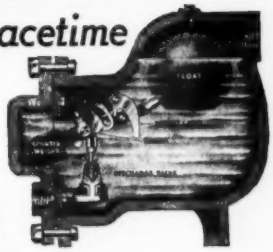
(Continued on page 374)

★ ★ ★ WAR PLANT RECORDS PROVE
YOU CAN DEPEND ON

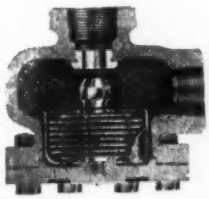
NICHOLSON "Fast Action" TRAPS



to Promote Peacetime Production Efficiency



Here are four reasons why Nicholson Traps won highest honors for "standing up to their jobs" under the punishing tests of forced wartime production—and why they're a "must" for the efficient and economical solution of peacetime plant maintenance problems: (1) Greater drainage capacity. (2) Advanced trouble-free design. (3) Fast, positive action. (4) Greater efficiency, repeatedly proved by plant records.



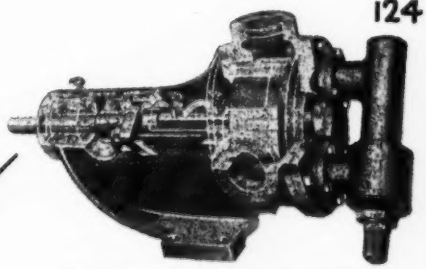
For EVERY POWER AND PROCESS PURPOSE

Catalog 444 or See Sweet's

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

Take A Look At The VIKING ROTARY PUMP

fig. 124



10 - 18 - 35 - 50 - 90 - 200 - 300 GPM

The Pump THAT OUT-SELLS ALL ROTARIES

Because of its simple design, sturdy construction and dependable, carefree service, the Viking Rotary Pump is the answer to most rotary pumping problems. Why not get the facts about Viking . . . learn what this famous pump can do for you?

Write today for Bulletin Series 2500W which illustrates and describes Viking pumps that are giving top-notch service in the power equipment field. It will be sent to you FREE by return mail.

VIKING Pump COMPANY CEDAR FALLS, IOWA

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

(Not available for equipment advertising)

15 cents a word, minimum charge $3.00. (See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line an insertion.

INFORMATION

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by October 12th will appear in the November issue, subject to limitations of space available.

POSITIONS WANTED
(Continued from page 273)

SIXTEEN YEARS design, construction, maintenance, and operation—power plants, refrigeration plants, central steam heating, air conditioning. Electrical graduate, formerly with electric utility, now naval (engineering) officer, qualified for immediate discharge. Desire new connection supervising all phases engineering for firm with number of plants. PW-911, Power, 68 Post St., San Francisco 4, Cal.

INSTRUMENTATION ENGINEER, mechanical. Age 41, twenty years experience in chemical and related industry, desires position in southern or mid-western states. Capable of assuming full charge of instrument engineering and maintenance or supervising installations for contractor or manufacturer. PW-912, Power, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER for engineering department of industrial plant. University graduate. 9 years experience in power plants, water treatment. Proficient in plant heat balance, combustion, fluid flow, thermodynamics, instrumentation. Broad experience, adaptable to any engineering position. PW-913, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POWER ENGINEER, specialist in electrical problems of the chemical and related industries desires responsible position utilizing seven years of university education in Europe and U. S. plus 15 years of diversified practical experience. Fluent knowledge of four languages. American citizen. Registered professional engineer N. Y. state. PW-914, Power, 330 W. 42nd St., New York 18, N. Y.

WATER SUPERINTENDENT. Five years experience municipal filter plant, three years industrial and boiler feed treatment, one year power house watch engineer. Licensed Michigan and Missouri. Age 36. PW-915, Power, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL MAINTENANCE Supervisor: now employed; excellent references. Twenty years experience in heavy and medium industry. Handle cost control, organization, personnel and industrial relations problems as well as the electrical. Familiar with all phases of the work including motor rebuilding. Location immaterial. PW-916, Power, 330 W. 42nd St., New York 18, N. Y.

WATER TREATING chemist and engineer, 12 years experience in all types industrial water treating, laboratory tests and supervision. Desires connection with firm in charge of water treating. Position must be permanent. Adequate housing and school facilities required. Available now. PW-917, Power, 520 N. Michigan Ave., Chicago 11, Ill.

THERMODYNAMICIST Ph.D. Broad background, physics, chemistry, industrial experience, research teaching. PW-918, Power, 330 W. 42nd St., New York 18, N. Y.

SALESMEN WANTED

SALESMEN WITH trade acquaintence, make up to $100 per day selling surplus listings. Part—full time. War Surplus Reporter, 20 East Jackson, Dept. 11, Chicago.

ASSISTANT SALES Manager wanted by old established manufacturer of water treating equipment. Must be a good engineer, preferably chemical, and have eight to ten years experience in successfully selling to the water treating field. Also require three sales engineers. Give full details in reply. SW-919, Power, 520 N. Michigan Ave., Chicago 11, Ill.

REPRESENTATIVES AVAILABLE

GRADUATE ENGINEER with six years sales experience in the power plant and heating fields desires opportunity as manufacturers representative on exclusive agency basis. Experienced in sales of industrial instruments, steam specialties, controls, and combustion equipment. At present officer in Naval Reserve. Location desired Pennsylvania or Ohio. RA-920, Power, 330 W. 42nd St., New York 18, N. Y.

SALES ENGINEERING organiaztion, established 15 years, desires to represent manufacturing of power, industrial or chemical plant equipment in the New York and New Jersey areas. Commission basis. RA-922, Power, 330 W. 42nd St., New York 18, N. Y.

GRADUATE ELECTRICAL—Mechanical engineer desires represent two additional companies southwest area. Refinery, industrial, or electrical equipment. Twenty years successful sales experience, three years operation. Recently resigned as district sales manager nationally known company. Acme Engineers, Box 5155, Houston 12, Texas.

SALESMAN AVAILABLE

MECHANICAL SALES Engineer desires position with a manufacturer's representative handling power plant and process equipment. Would like opportunity where there are present or future possibilities of acquiring some ownership. SA-921, Power, 330 W. 42nd St., New York 18, N. Y.

Salesman Wanted
FOR
Heavy Machinery

One of our clients, a leader in its field, has an opening for a high type salesman in the East, another in the Midwest and one in the South. Engineering background not essential, but experience in selling heavy machinery directly to industry and ability to draft preliminary layouts in detail are required. Salary and bonus enable earnings to $6,000 and up depending on results. Apply by letter only giving complete resume of experience, past earnings, education, age, etc.

BARRINGTON ASSOCIATES
52 Vanderbilt Ave., New York, N. Y.

WANTED
RELIABLE SALES ENGINEERS
to represent established manufacturer of Fuel Burning Equipment, Industrial Oil, Gas, Pulverized Coal Burners and Refinery Equipment.
FABER ENGINEERING COMPANY
Amber & Westmoreland Sts.
Philadelphia 34, Pa.

WANTED
SALES ENGINEERS!

Or organization familiar with boiler operation and having wide acquaintance with the industrial, railroad and marine trade. Our product is consumable therefore offers a large potential repeat business. Its efficacy has been proven through years of continuous use by industrial plants, railroads and marine trade.

SW-902, Power
520 N. Michigan Ave., Chicago 11, Ill

REPRESENTATIVE AVAILABLE

Would you like to be represented in the Philadelphia territory by a sales engineer, who has been established in that field for 15 years? Full details requested on your present volume in Philadelphia district.

RA-924, Power
330 W. 42nd St., New York 18, N. Y.

To Employers Who Advertise for Men:

The letters you receive in answer to your advertisements are submitted with the hope of securing the position offered.

Frequently, when, there are many applicants, the only letters acknowledged are those of promising candidates. Others receive no indication that their letters have even been received, much less given consideration. These men often become discouraged, will not respond to future advertisements and even question their bona fide character.

Every Advertisement Printed in the Searchlight Section Is Duly Authorized. Now won't you help keep our readers interested in this advertising by acknowledging every application received, even if you merely return the letters of unsuccessful applicants marked, "Position filled, thank you." If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of helpful co-operation between employers and the men replying to Positions Vacant advertisements.

Departmental Staff
McGRAW-HILL PUBLISHING COMPANY, INC.
"Put Yourself in the Place of the Other Fellow"

(Employment Wanted Advertisements page 392)

Why Users like Hemphill Quality Equipment

"Hemphill buys it before I do – it must be good equipment!"

Naturally we are doubly particular about equipment – for two reasons. First – *we invest our own money* in buying or acquiring control of equipment to sell to you. And – second – we cannot afford to lose customers (and our reputation) by selling a poor piece of equipment. So naturally the graduate Electrical Engineers on our staff make doubly sure that every piece of equipment we get, and sell, is GOOD VALUE.

The Hemphill SEAL JLHCo OF QUALITY GUARANTEES ENGINEERED RECONDITIONING

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 1200 RPM, 220 volt, Westinghouse squirrel cage.
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
3—225 HP, 1200 RPM, 220 volt, General Electric, squirrel cage.
1—200 HP, 600 RPM, 2200 volt, G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
1—150 HP, 400 RPM, 440 volt, General Electric squirrel cage.
1—125 HP, 1800 RPM, 2200 volt, Continental, squirrel cage.
2—100 HP, 7220 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1— 90 HP, RPM, 550 volt, Cr. Whir., sq. cg.
1— 75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1— 75 HP, 1200 RPM, G.E., sl. rg.
1— 60 HP, 1200 RPM, 220 volt, General Electric, slip ring.
1— 50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1— 50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

2—450 HP, G.E., 440 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—200 HP, 425 RPM, G.E.
2—125 HP, 1170 RPM, G.E.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1— 75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.

MOTORS—D.C. 230 VOLTS (Con't.)

1—50 HP, 700 RPM, Crocker-Wheeler.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
1—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—18/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse
1— 5 HP, 600/1200 RPM, General Electric.
1— 5 HP, 450/1800 RPM, Crocker Wheeler.
1— 5 HP, 400/1600 RPM, Diehl.
1— 5 HP, 225/900 RPM, Electro Dynamic.

MOTOR GENERATOR SETS

1—150 KW, 250 volt, Westinghouse, slip-ring.
1—150 KW, 125 volt, Westinghouse, squirrel cage.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 65 KW, 125 volt, Westinghouse, squirrel cage.
1— 20 KW, 600 volt, General Electric, squirrel cage induction motor.
2 15 KW, 250 volt, General Electric, squirrel cage.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—375 KVA, Westghse., non-condensing.
1—300 KW, 125/250 General Electric non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1— 30 KW, 135 volt, Allis Chalmers non-condenser.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 2300 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chal.
1—150 KVA, 900 RPM, 2300 volt, G.E.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chal.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33000/2300/4000 Y.
2—100 KVA, General Electric, 2200/220/440 volt.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200/250 volts.
3— 75 KVA, Westinghouse, 2200/220/110 volts.
3— 75 KVA, G.E., 13,500-750/440 volts.
1— 75 KVA, G.E., 3 phase, 4156Y—120/208Y.
2— 50 KVA, Pbgh., 7500/15000 volts-110/220 volts.
2— 15 KVA, G.E., 2300-115/230 volts.
2—100 KVA, G.E., 2400/240/480.

GASOLINE DRIVEN D.C. GENERATOR SETS

2—25 KW, 125 volt.
1—30 KW, 125 volt.
1—120 KW, A.C. 240 volt, 3 phase.

It's Hemphill for Power!

J. L. HEMPHILL & CO.

Electrical Engineering and Equipment

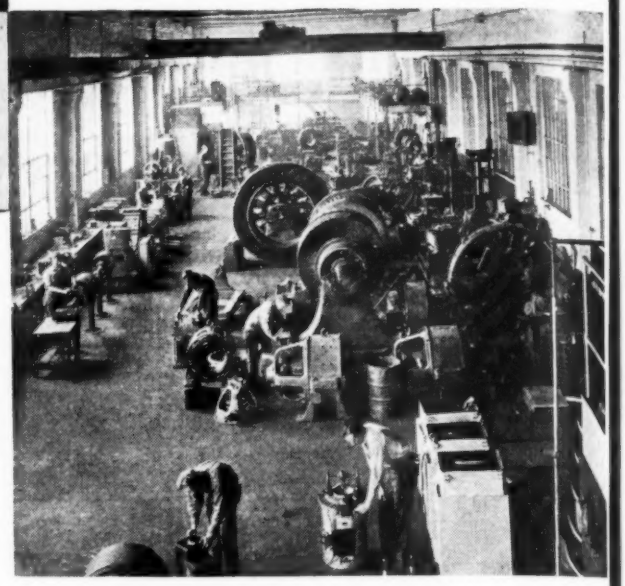
OFFICE AND WAREHOUSE:
1601 53rd STREET
PHONE NEW YORK—LONGACRE 5-3227

JLHCo

NORTH BERGEN, N. J.
PHONE NEW JERSEY—UNION 3-2600

You've heard about **BELYEA RE-NU-BILT**

Here's a view of the shop that backs our reputation



The facilities and layout of our plant are designed for THOROUGHNESS in rebuilding electrical power equipment in all sizes, from the largest and heaviest to those in our small motor department.

The rebuilding tolerances of all RE-NU-BILT equipment are in accordance with the adopted "Rebuilding Standards of NISA." (Copy of Standards furnished on request.) The Belyea one year guarantee is backed by our 37-year reputation for reliability.

Here's what BELYEA offers today—only partial Stock Listing

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E. 250/275 V. D.C. to 2100 H.P., 2300 V.
1—500 KVA—300 KW—220/440 V. A.C. Gen. to 500 H.P.—230 V. D.C. Motor.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—300 KW Whse. 275 V. D.C. to 450 H.P. 4000/6600 V. with exciter.
1—288 KVA Whse., 440 V. A.C. Gen. DC to 304 H.P. —115 V. DC Motor.
1—240 KW Whse., 125 V. DC Gen. DC to 380 HP —440 V.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
1—50 KW G.E., CD 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.
1—46 KW Al. Ch. Balancing Set 125/250 V.
1—45 KW Whse. 250 V. D.C. to 75 H.P. 440 V. Sq. Cg.

3 Phase 25 Cycle

1—25 KW G.E., 125 V. D.C. to 35 H.P., 360 V. Motor.
1—75 KW Whse., 125 V. D.C. to 110 H.P., 440 V. Motor.
1—250 KW G.E., 250 V. D.C. to 285 KVA. 6600 V. Motor.

TRANSFORMERS—POWER AND DISTRIBUTION

60 CYCLE (Unless Otherwise Noted)

Qu.	KVA	Make	Ph.	Type	Voltages
3	1667	Pitts.	1	OISC	13200x2300
1	1050	G.E.	3	WCTH	11000x445/222½
4	525	G.E.	1	HJ	2300x445
2	450	G.E.	3	HTDD	6600x240
4	500	Pitts.	1	OISC	13200x2300
2	333	Pitts.	1	OISC	2400x220
2	333	Whse.	1	OISC	2300/460
1	300	Pitts.	3	OISC	4150x208/120
3	200	G.E.	1	HLLD	27600x115/460
2	200	G.E.	1	HKDD	13800x220/440
1	200	Whse.	1	SK	6600x220/440
3	200	G.E.	1	HJ	2300x408/204
1	200	G.E.	2-3	Auto	2500x2500
1	200	G.E.	1	H	2300x115x230
3	150	Maloney	1	C	2300x220/440
7	125	Maloney	1	C	2300x220/440
3	100	G.E.	1	HJDD	13200x445/226
3	100	Whse.	1	OISC	13200x250
1	100	Whse.	1	OISC	11430x250
2	100	G.E.	1	A	2200x120/240

A.C. MOTORS

3 Phase 60 Cycle

SLIP RING

Qu.	HP	Make	Volts	RPM	Desc.
1	100	G.E.	440	575	IM
1	100	G.E.	550	685	MTC-5552
1	100	G.E.	550	720	IM
1	100	G.E.	2200	1750	IM
1	100	G.E.	220	1750	IM
1	150	Whse.	440	435	CI-954A
1	200	G.E.	2200 550	1750	IE-13B
1	200	G.E.	440	450	IM (3 Brg.)
1	200	Whse.	440	580	CW
1	200	Al. Ch.	440	505	
1	250	G.E.	4000	257	MT-424Y
1	250	Al. Ch.	440	505	ANY
1	350	G.E.	4000/2200	253	MT-442Y
1	400	G.E.	2200	252	IP
1	400	A.-C.	2300	5505	ANY
1	450	Whse.	2200	875	CW
1	500	Al. Ch.	2200	590	ANY-36
1	600	Cr. Wh.	2200	507	131-AQ
1	800	A.-C.	400	885	ANY
1	1200	C.W.	2300	237	801Q
1	2500	G.E.	6600	253	MT

SQUIRREL CAGE

Qu.	HP	Make	Volts	RPM	Desc.
1	150	Whse.	440	400	CS-594A
2	175/112	G.E.	440	990/720	IK
1	200	G.E.	440	580	IK
2	200	G.E.	2300	1175	IK
1	200	G.E.	2200	490	IK
1	200	G.E.	550	580	IK
1	300	G.E.	440	900	IK
1	300	Whse.	550	580	CS

SYNCHRONOUS

Qu.	HP	Make	Volts	RPM	Desc.
1	75	G.E.	220	600	TS 7556
1	600	Al. Ch.	2300	720	
2	2100	G.E.	2200/4400	514	ATI

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed	Desc.
1	750	G.E.	220/440	900	ATI
2	2100	G.E.	2300/4600	514	ATI
1	3000	Al. Ch.	2300	900	
1	5000	Whse.	2300/4000	900	

3 Phase 25 Cycle

1	75	Al. Ch.	440	750	ANY
1	150	G.E.	440	500	IM
	200	G.E.	440	242	Sl. Rg.
	300	G.E.	6600	750	ATI
1	1400	G.E.	2300	500	ATI

ROTARY CONVERTERS

3 Phase 60 Cycle

Qu.	KW	Make	Speed	Dc V.	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	720	250	22000
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
2	375	G.E.	1200	250	6600/2300
2	300	G.E.	1200	600	2300
1	300	Al. Ch.	1200	250	2400

3 Phase, 25 Cycle Booster Type

2	1500	G.E.	500/225/275/13200/6600
1	500	G.E.	750/225/275/13200/6600

All units can be furnished with AC and DC controls

SPECIAL

1—2000 amp. 3 Pole, 15000 V. Condit type F-128-15D 230 V—Sol. operated OCB—1000000 Kva. interrupting capacity

D.C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	180
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	G.E.	MPC	230	900
1	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.		230	525
1	200	Whse.	SK	230	400
3	135/175	G.E.	MCF	230	450/1050
1	150	G.E.	MPC	230	250/450
2	130	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625
1	100/150	Whse.	SK-200	550	600
1	100	Whse.	SK-180	230	600
1	50/100	G.E.	MPC	230	225/450
1	75	G.E.	C	230	500/1000
1	60	El. Dy.	258	230	525/1050
1	50/60	Cr. Wh.	CMC-65H	230	500/1000
1	50	Cr. Wh.	CMC-80H	230	380/750
1	15/50	Cr. Wh.	CMC-81H	230	300/900
2	40	El. Dy.	305	230	300/900
1	40	G.E.	CD-123	230	500/1500
1	35	Rel.	310T	230	400/1600
1	35	G.E.	RF-14	230	400/1600
3	25/30	G.E. (new)	CD-1136S	230	400/1600
17	30	Whse.	SA	230	500/1500
2	16/25	Cr. Wh.	CMC-355A	230	400/1200
1	25	Whse.	SK-150	230	300/1200

SUCCESSFUL OPERATION GUARANTEED
Quality without Question

BELYEA CO., INC.

Main Office and Shop
43 HOWELL ST., JERSEY CITY, N.J.

RE NU BILT BELYEA MOTORS

"U.E.M." - that's all you need to remember

A single source for every type of POWER PLANT MACHINERY

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

3125 KVA G.E. condensing, 225 lbs. pressure, 500° TT, 2300 volts, 3600 RPM equipped with either a surface or jet condenser, switchboard and instruments.

1875 KVA G.E. condensing, 175-200 lbs. pressure, 500° TT, 6600 volts, 3600 RPM complete with condenser.

1875 KVA Elliott condensing, 300 lbs. pressure, 2300 volts, 3600 RPM, complete with shaft exciter, switchboard, condenser and condensing auxiliaries — Modern.

1250 KVA Westinghouse non-condensing, 200-250 lbs. pressure, 500° TT, 15 lbs. gauge back pressure, 480 volts, 3600 RPM complete with exciter, switchboard panel and instruments.

1250 KVA Elliott condensing, 175-300 lbs. pressure, 240 volts, 3600 RPM complete with jet condenser and auxiliaries.

940 KVA Westinghouse condensing, 250 lbs. pressure, 500° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

937 KVA G.E. condensing, 150-175 lbs. pressure, 2300 volts, 3600 RPM complete with direct connected shaft exciter, surface condenser and auxiliaries.

780 KVA Westinghouse non-condensing, 175-200 lbs. pressure, 15 lbs. back pressure, 480 volts, 3600 RPM complete with switchboard.

625 KVA G.E. non-condensing, 175 lbs. pressure, 20 lbs. gauge back, 2300 volts, 3600 RPM, complete with direct connected shaft exciter, switchboard and instruments.

375 KVA G.E. condensing, 150-200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

125 KVA Westinghouse non-condensing, 175-200 lbs. pressure, 0-10 lbs. gauge back, 240 volts, complete with direct connected exciter and switchboard.

125 KVA G.E. non-condensing, 125 lbs. pressure, 0 to 10 lbs. gauge back, 240 volts, 3600 RPM complete with direct connected exciter and rheostats.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle Alternating Current

900 KVA Allis-Chalmers, 480 volts, 150 RPM generator direct connected to 24" x 36" Filer Stowell semi-Unaflow engine.

625 KVA G.E. 2300 volts, 150 RPM generator direct connected to 26½" x 36" Skinner Unaflow non-condensing engine, 150 lbs. pressure, complete with exciter and switchboard.

500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140-160 lbs. pressure, 0 to 10 lbs. gauge back pressure. Complete Installation.

375 KVA G.E. 240 volts, 200 RPM generator direct connected to 22" x 24" Skinner Unaflow non-condensing engine, 150-175 lbs. pressure, 5 lbs. gauge back pressure.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator direct connected to 17" x 24" Elliott Unaflow non-condensing engine, 175 lbs. pressure, 6 lbs. gauge back pressure.

312 KVA Westinghouse 240/480 volts, 200 RPM generator direct connected to Skinner Unaflow non-condensing engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110-125 lbs. pressure, 5 lbs. gauge back pressure.

156 KVA G.E. 240 volts, 225 RPM generator direct connected to Nordberg Unaflow engine.

125 KVA G.E. 240 volts, 257 RPM generator direct connected to 17" x 16" Skinner Unaflow engine, 100-130 lbs. pressure, 5 lbs. gauge back pressure.

ENGINE-GENERATOR UNITS

Direct Current

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to Ames vertical Unaflow non-condensing engine.

125 KW Elliott, 125 volts, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lbs. pressure, 10 lbs. back pressure, complete with switchboard.

75 KW Westinghouse, 125 volt, 1800 RPM non-condensing turbine-generator unit.

75 KW Allis-Chalmers Terry, 125 volt, 2400 RPM non-condensing turbine-generator unit.

15 KW (3) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to American Blower vertical engine.

SPECIAL OFFERINGS

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

1690 C.F.M. 110 lbs. air pressure Ingersoll-Rand steam driven air compressor 125-150 lbs. steam pressure.

750 KVA Westinghouse 3 phase, 60 cycle, 2300 volt alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volt, 300 RPM synchronous motor.

1200 KVA G.E. 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP 3 phase, 25 cycle, 2300 volt, 300 RPM synchronous motor.

750 HP Babcock & Wilcox Sterling water tube boiler ASME National code, 225 lbs. pressure, complete with stoker.

528 HP Heine water tube boiler ASME code, 200-300 lbs. pressure, less stoker.

125 KVA (10), 3 phase, 60 cycle, 480 volts, 514 RPM horizontal synchronous generators complete with exciters and rheostats suitable for direct connection to Diesel engines.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

DEPENDABLE ELECTRICAL EQUIPMENT

L. J. Guarantee

Rebuilt equipment in accordance with specifications as quoted is sold by us completely and thoroughly shop reconditioned, tested and guaranteed for a period of one year from date of shipment, when operated under normal load, usage and conditions with proper care and competent supervision. Any mechanical or electrical parts proving defective under normal operation will be repaired or replaced (at our option) by us, f.o.b. our plant, New York, N. Y. We are not responsible for consequential losses or damages, outside of this equipment nor for repairs or replacements made by others without our written authorization. Correction of defects by repairing or replacing by us shall constitute fulfillment of all our obligation to the purchaser.

1 YEAR!

SQUIRREL CAGE MOTORS
3 ph. 60 cy.

Qu.	HP	Make	Type	Speed
1	200	G.E. 440 v.	IK	600
1	147	West. 25 cy.	CS	715
1	100	Al. Ch.		690
2	100	G.E. 440 v.	PTA56	375 750
1	85	G.E. 2300 v.	PT529	3600
1	75	Burke		1150
1	50	Star	A75	1750
1	50	West.	CCL	1150
1	50	Al. Ch.		865
1	50	Cr. Wh.		865
1	50	Burke		690
1	50	West.	CS	580
2	45	W. E.		150/900
1	40	West.	CS	1760
1	40	G.E.	KT	1150
1	40	Lincoln		1150
1	35	Wagner		850
1	35	West.	CS	690
1	30	U. S. Vert.	CPU907	3450
1	30	A-C		1150
1	30	Diehl		860
1	30	Cr. Wh.		870
1	30	Al. Ch.		870
1	30	G.E.	KT342	690
1	30	West.	CCL	690
1	30	G.E.	IK	514
1	25	Triumph		1750
1	25	G.E.	KT302	1750
1	25	Wagner 220v.	F-W	1200
1	25	Al. Ch.		1150
1	25	West.	CS	1150
1	25	El. Dy.	KMQ444	865
2	25	G.E.	IK	865
2	25	Diehl	IS167	865
1	25	West.	MS	860
1	25	Wagner 440v.	F. W.	720
125	12	G.E.	445	840/405
1	20	West.	CS365	3500
1	20	G.E.	KT312	1740
1	20	G.E. Vert.	PT501	1750
9	20	El. Dy.	KNX364	1750
1	20	F.M.	KMV12D	1150
2	20	G.E. Vert.	KT512	1150
1	20	Cr. Wh.		1150
1	20	F. & M.		1160
2	20	West.	CS	1160
1	20	G.E.	KT332	1160
2	20	Al. Ch.		860
1	20	F.M.		860
1	20	Diehl		860
1	20	West.	CS566	870
1	20	G.E.	KT326	870
1	20	G.E.	IK	690
1	20	West.	CS584	690
1	20	West.	CCL	690
1	15	Burke		1750
1	15	Wagner 220v.	P-W	1800
21	15	El. Dy.	326	1750
1	15	Lincoln		1150
1	15	G.E. Vert.	KT502	1150
1	15	West.	CCL	1150
3	15	West.	MS	1150
1	15	West.	CS	1150
1	15	G.E. Vert.	IK	860
1	15	West.	CS	860
1	15	Wagner 404v.	F-W	720
1	15	G.E.	IK	720
1	15	West.	CS504	415
3	10	G.E.	KT	3600
1	10	Cr. Wh.	Gr.Hd.	400
12	15	West.	CS 445	600/900 1200/1800

SQUIRREL CAGE MOTORS
2 ph. 60 cy. type

Qu.	HP	Make	Type	Speed
1	100	West.	CS663C	1750
1	75	G.E.	IQ	1750
1	70	G.E. Synch.	AQ1	1200
1	50	Lincoln		870
1	50	G.E.	IQ	870
1	40	Al. Ch.		870
1	40	F-M		870
1	35	Al. Ch.		870
1	30	West.	CCL	1150
1	25	G.E.	KQ312	1750
3	25	G.E.	ICL	1150
1	25	West.	CCL	1150
1	25	Burke		900
1	20	West.	CS	1160
1	15	F-M		1750
1	15	G.E.	KQ502	1150
1	15	West.	CS4	1150
1	15	G.E.	IQ	720

SLIP RING MOTORS
2 & 3 ph. 60 cy.

Qu.	HP	Make	Type	Speed
1	450	G.E.	MT412	500
1	250	G.E.	IM	580
1	150	El. Dy.	New	1770
1	100	G.E.	MTC5546	800
1	100	G.E.	IM	900
1	100	G.E.	IM	690
1	100	F.M.	FA	690
1	75	West.	HF	1160
1	75	Al. Ch.		865
1	75	Al. Ch.	ANY	575
1	65	G.E.	MTC552	585
1	60	West.	CW648	1150
1	60	West.	CW950A	290
1	50	G.E.		870
1	40	Wagner		1150
1	40	F-M		870
1	40	West.	CW	870
1	40	G.E.	MT312	570
1	35	Burke		690
1	30	G.E.	MC332	870
2	30	G.E. 2200 v.	MT542	690
1	25	West.	CW	1160
1	25	Louis Allis		1750
2	25	Al. Ch.	ANY20G	870
1	25	Burke	FMV3	870
1	25	Howell	SFS420	870
2	15	G.E.	MT502	1150
1	15	West.	CW	870
1	15	Cleveland	MW147	870

A. C. GENERATORS

Qu.	Kw	Make	Voltage	Speed
1	150	G.E.	220/440	600
1	150	Cr. Wh.	220/440	900
1	100	West.	220/440	600
1	35	Allen	220/440	900
1	35	Burke	220/440	720
1	50	Elec. Mchy	220/440	900
1	25	West. 1 ph.	110/220	1200

A.C. TURBO GENERATOR

625 KVA Westinghouse Geared Turbine, 150 lbs., 35 lbs. back pressure, 3 ph. 60 cy' 2400 Volt, .8PF also driving.

D.C. MOTOR GEN. SETS

2—300KW Burke 3 wire 250/125 Volt D.C. 900 RPM, 3 ph., 60 cycle, 4150 Volts Synchronous, Factory Built.

1—250KW General Electric, 125 Volt Direct Current, 720 RPM.

230 V. D.C. MOTORS

Qu.	HP	Make	Type	Speed
1	350	West.	SK	340/425
1	150	West.	S	600
1	60	G.E.	LC	450/1160
1	60	El. Dy.	258	450/900
1	50	El. Dy.		900
1	50	West.	SK 150	550/1100
1	45	Diehl		850
1	40	G.E.	DLC	1050
1	40	Cr. Wh.	CCM	915
1	35	West.	SK	1150
1	35	West.	SK120	975
1	35	G.E.	DLC204	440/880
2	35	West.	SK160	400/600
2	30	G.E.	CD83	3450
1	30	G.E.	RC	1150
1	30	West.	SA	975
1	25	G.E.	RC	1150
1	25	West.	SK	1150
1	25	Diehl	K8	850
1	25	Louis Allis	Encl.	900
1	25	Al. Ch.		850
1	25	El. Dy.		1500
1	25	G.E.	CD113	575
1	20	G.E.	CD83 1200	1600
1	20	R. & M.		1150
1	20	G.E.	RC	1150
1	20	El. Dy.		950
1	20	G.E.	RC	800
1	20	West.	SK110L	750
1	15	Roch.	SV5	3450
3	15	G.E.	RC	1150
2	15	G.E.	CD	1150
1	15	G.E. Vert.	CD	900
1	15	West.	SK	850
1	15	G.E.	RC	850
1	15	West	SK	600/2500
1	13	Diehl		200/247
1	10	G.E.	RF	450/1800
1	10	G.E.	CD	1150
1	10	West.	SK	400/1200
3	10	G.E.	RC	850
1	10	G.E.	CVC	700
1	10	Diehl		750
1	10	West.	SK	600/1200
1	10	El. Dy.		450/1800
1	10	G.E.	RF	400/1600
2	10	West.	SA	400/1200
1	10	G.E.	RF	450/1800
1	8½	Diehl		900
1	8½	West.	SK	850
1	8½	West.	SK90	350/1400
1	8	G.E.	RLC	500/1500
1	7½	G.E.	RC	1700
1	7½	G.E.	CVC	1525
1	7½	West.	SK	1450
3	7½	G.E.	RC	1150
2	7½	G.E.	RC	1150
1	7½	West.	SK	950
1	7½	Al. Ch.		850
1	7½	G.E.	RC	850
3	7½	G.E.	RF	600/1800
1	7½	El. Dy.		550/1650
1	7½	Watson		525/1150
2	7½	G.E.	RF	450/1800
1	7½	West.	SK	450/1600
1	7½	Al Ch.		350/1050
1	3	West.	Gr. Hd.	12½

110 V. D.C. Motors

Qu.	HP	Make	Type	Speed
1	90	G.E.	DLC65	90
1	20	EK	RC	115
1	15	Eck.		1000
1	15	El. Dy.		615/1230
1	10	El. Dy.	38	1100
1	10	West.	SK	850
1	10	El. Dy.	7½8	425/1275
1	10	Diehl		230
1	7½	Cr. Wh.		900
1	7½	West.	SK	500
1	7½	El. Dy.	58	450/900
2	7½	El. Dy.	38	600/1200

D.C. GENERATORS

KW	Make	Volts	Amps	Speed
300	West.	250	1200	900
250	G.E.	125	2060	720
100	West.	250	400	720
100	Al. Ch.	250	400	575
100	G.E.	125	800	1150
50	G.E.	250	200	870
50	G.E.	125	400	1150
40	El. Dy.	250	160	1150
30	Reliance	250	120	1750
30	West.	125	240	1160
30	El. Dy.	600	50	1150
25	West.	125	200	1150
25	El. Mchy Syn.	125	200	1200
25	G.E.	250	100	1150
20	G.E.	125	160	1150
20	West.	250	80	1150
15	Burke	125	120	900
15	G.E.	250	60	1150
10	Al. Ch.	125	80	1150
10	G.E.	250	40	1150
7½	West.	250	80	1150
7½	G.E.	125	60	1150
5	G.E.	250	20	1150
5	West.	125	40	1150
5	G.E.	600	9	1750

D.C. TO A.C. GENERATORS

1—4 KVA Hertner, 115 v. DC to 115 v. 60 cy. 1 phase.
1—7½ KVA Century 115 v. DC to 115 v. 60 cy. 1 phase.

ELECTRONIC Speed Regulated Motor Drive

300 KW West. SK 250 Volt D.C. Generator 900 RPM. with 350 HP West. SK 250 V. D.C. Motor, double end shaft, speed 0 to 600 RPM. Complete with Pilot Generator, all control and necessary 4 unit Motor Generator exciters.

COOLANT PUMPS

50 New Ruthman (Gusher) Coolant pumps, with ¼ H.P. 3 ph. 60 cy. 220/440 Volt Motors.

800 & 400 Cycle Generators

3—1 KVA Holzer Cabot 3 ph. 60 cy. 220/440 V.
2—1 KVA—800 cycle.

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NEW YORK CITY'S LARGEST STOCK OF ELECTRICAL MACHINERY

L. J. LAND & COMPANY

ESTABLISHED 1910

146 GRAND ST., NEW YORK 13, N. Y. CAnal 6-6976

Branch Offices:
10th & Exeter Streets, Reading, Penna.

Below BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

ONLY PARTIAL LIST

TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts, 1 PH. 25 cy.
3—200 K.V.A. Gen. Elect. type A form L 2400/240/480 Volts 1 Ph. 60 cy.
1—100 KVA GE, type H Form KDD 11000/2600 volt, 1 PH. 60 cy.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle, 3 phase, 450 R.P.M. with direct connected exciter.
200 KW, Westh. Unity Power Factor, 3 PH, 60 cyc. 220/440 900 R.P.M. with direct connected exciter
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field. and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

FREQUENCY CHANGERS

30 KVA, Gen. Elect. type I.T.T. frame 526 P.F. 08—220/440 volts 3 Ph. 60 cy. to 240 volts 120 cycle Motor KT frame 526—3 Ph. 60 cy. 220/440 volts 1200 RPM.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. Motors

H.P.	Make	Type	Speed	Volt
350	Gen. Elec. Sl. Rg. 3 Brg	I	375	400
250	Gen. Elec. S. R.	I. M.	500	440
200	Lincoln S. R.	I. X. W.	500	400
100	West. Syn. Stator and Rotor	H. R.	300	2200
100	Wagner Sl. Rg.	BR	750	220/440
70	Gen. Elec. Syn. Stator and Rotor	AT1	167	2200

3 ph. 60 cy. A. C. Motors

H.P.	Make	Type	Speed	Volts
200	West. Syn.-Dir. Con. Ex.	P. F. 08	900	220/440
200	Gen. Elec. Syn.	AT1	514	4000/2300
200	Weghse. Syn.	Dir. Con. Exc.	600	2300
150	Gen. Elec. Syn. Stator and Rotor	AT1	400	2200
25	Gen. Elec. Sq. Cg.	I. K. Vert.	720	220

230 Volt D. C. Motors

H.P.	Make	Type	Speed
75	Crocker Wh.	CCM25JA	700
60	Sprague	D — Comp. Wound	625
40	Fair. Morse	Ball BRG. Vert. Comp.	1740

125 Volt D. C. Motors

H.P.	Make	Type	Speed
60	Allis Chalmers	FB131-Comp. V. B. Pipe Vent.	1755

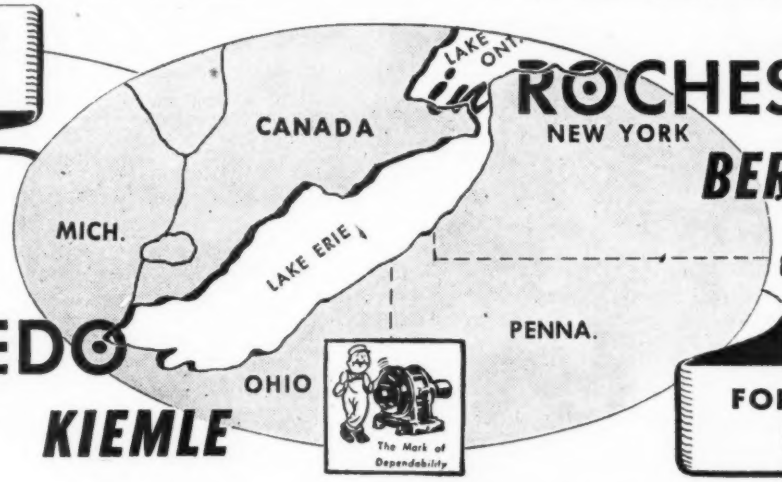
550 Volt D. C. Motors

H.P.	Make	Type	Speed
35	West.	Sk 150 Shunt Int.	850

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V. 600 R.P.M.
50 KW—Northern—Comp. 110 V.—700 R.P.M.

OVER 10,000 STOCK ITEMS



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TOLEDO 4 OHIO

BERGER BROTHERS ELECTRIC MOTORS, Inc
395 STATE ST.
ROCHESTER 4
NEW YORK

FOR IMMEDIATE DELIVERY

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH, 60 Cy.
3— 50 KVA Pittsburgh 60 cycle, 1 Ph, 440/110/220 Volts.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 2200 Volts—1800 R.P.M.

WEST. D.C.—VARIABLE SPEED MOTORS

10—10 H.P. Type S.K. 230 V. 500/1500 R.P.M. with Automatic Dynamic Braking Starters and Field Rheos.

SYNCHRONOUS—CONVERTER

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
200	Electric Mach.	Syn.	Stator and Rotor	257	440
200	Wsghse.	Sl. Rg.	CW	600	220/440
150	Gen. Elec.	S. R.	I. M.	400	440
100	Lincoln		M	1150	440
100	Allis. Ch.	S. R.	A. N. Y.	600	440

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	1M	500	440
100	Allis Ch.	S. R.		750	440
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S. R.	I. M. 17B	160	440
75	Gen. Elec.	Sl. Rg.	I. M.	760	220/440

230 Volt D. C. Motors

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
60	Gen. Elec.	C-Shunt Wd	600
50	Crocker Wheeler	CM	625

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Each rebuilt unit is carefully selected, completely dismantled, reconditioned and rebuilt with standard parts in our own shops. Our separate compressor and electrical departments have full facilities for rebuilding compressors and motors to the rigid requirements of the famous O'BRIEN guarantee.

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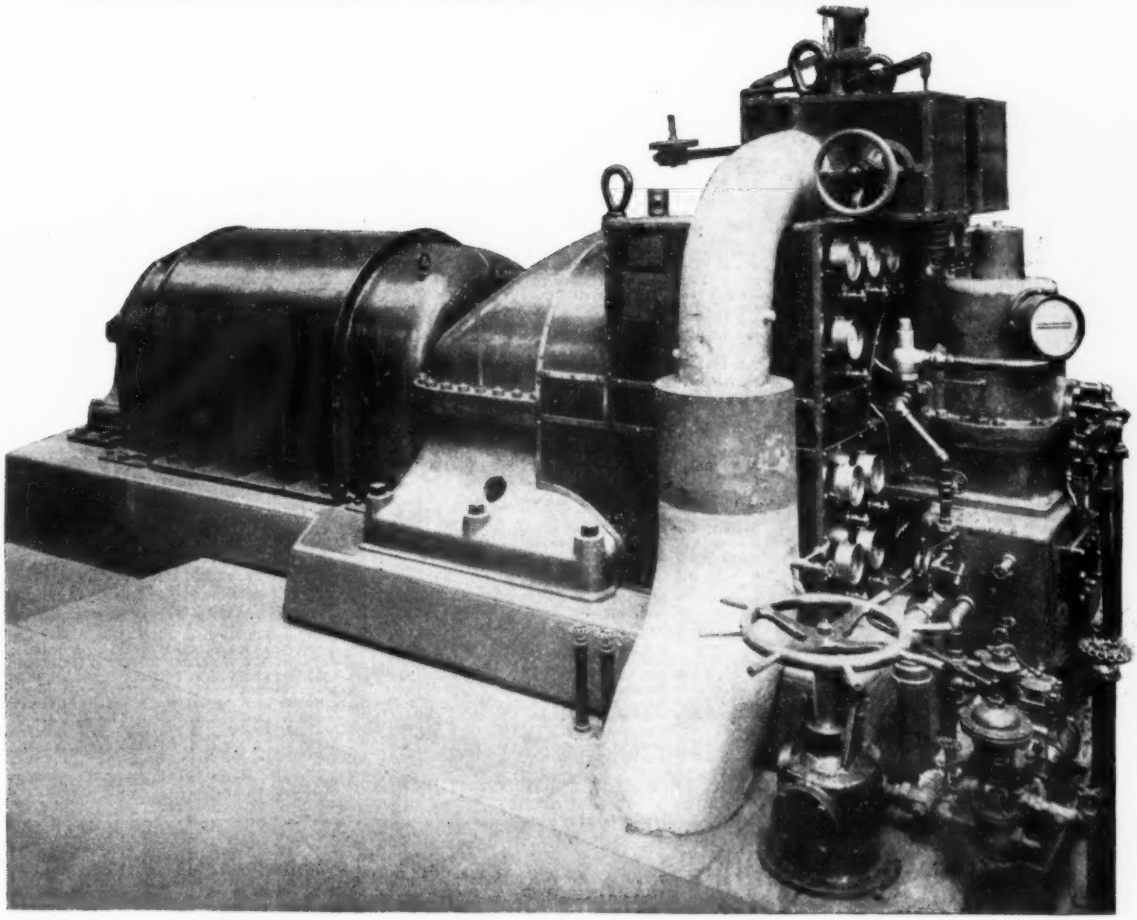
RUA CANDELARIA, 9 RIO DE JANEIRO — BRASIL

1875 KVA WESTINGHOUSE AUTOMATIC EXTRACTION TURBINE GENERATOR UNIT



Actual Photograph

1875 KVA Westinghouse alternating current generator 3 phase 60 cycle, 480 volts, 3600 RPM, direct connected to 1875 KVA Westinghouse automatic extraction type condensing turbine, 175-250# steam pressure, 600 degrees maximum T.T., 0-25# extraction pressure 3600 RPM.
Generator equipped with air filter, exciter and switchboard. Turbine equipped with 3200 sq.ft. Wheeler surface condenser, pumps, air ejectors, inter-connecting piping and cooling tower.

STEAM TURBINE GENERATOR UNITS

3 phase 60 cycle

1563 KVA Allis Chalmers-Kerr noncondensing turbine generator unit, 2300 volts, 150-200# steam pressure, 0-15# back pressure.

937 KVA General Electric condensing turbine generator unit, 2300/480 volts, 150# steam pressure, with surface condenser.

625 KVA Westinghouse noncondensing turbine generator unit, 2300/240 volts, 175-250# steam pressure, 0-30 back pressure.

312 KVA Crocker Wheeler-Moore noncondensing turbine generator unit, 240 volts, 425# steam pressure, 18# back pressure, 75-125# bleeder pressure.

STEAM ENGINE GENERATORS

3 phase 60 cycle

500 KVA General Electric generator, 2300 volts, direct connected to Nordberg uniflow engine, 150-200# steam pressure, 20# back pressure.

312 KVA General Electric generator, 240/480/600/2300 volts, direct connected to Skinner uniflow engine, 125-175# steam pressure, 12# back pressure.

225 KVA Electric Machinery generator, 240/480/600/2300 volts, direct connected to Chuse uniflow engine, 125/150# steam pressure, 10# back pressure.

156 KVA General Electric generator, 240/480/600/2300 volts direct connected to Skinner uniflow engine, 150# steam pressure, 5# back pressure.

ROTARY CONVERTERS

250 volts direct current

2250 KW (2) Westinghouse rotary converters, 230/300 volts direct current, 450 RPM, with 3 phase 60 cycle 13200 volt transformers and switching equipment.

1000 KW Westinghouse rotary converter, 250 volts direct current, 514 RPM, with 3 phase 60 cycle 13200 volt transformers.

500 KW General Electric rotary converter, 220/250 volts direct current, 1200 RPM, with 3 phase 60 cycle 2300 volt transformers and switching equipment.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.
1—22500 KW General Electric Cond.
1—15300 KVA Westinghouse Cond.
1— 7500 KVA General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 3125 KVA General Electric Extrac.
1— 2500 KVA General Electric Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
2— 625 KVA General Electric Non-C.
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

D. C. TURBO UNITS
1—1500 KW General Electric 250 V.
2—1000 KW General Electric 250 V.
1— 125 KW General Electric 125 V.
1— 75 KW General Electric 125 V.
1— 25 KW Westinghouse 125 V.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 375 KVA Skinner Uniflow
1— 350 KVA Ames Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 300 KVA Skinner Uniflow
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 93.8 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS
1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS
1—625 HP Worthington, 240 V. 60 cy. gen.
1—520 HP Busch Sulzer, 2400 V. 60 cy. gen.
1—450 HP M.A.N., 2300 V. 60 cy. gen.
1—440 HP Nordberg, 250 V. DC gen.
3—420 HP Fair.-Morse, 2400 V. 60 cy. gen.
1—375 HP Worthington, 240 V. 60 cy. gen.
1—375 HP McInt. & Sey., 240 V. 60 cy. gen.
1—320 HP Winton, 240 V. 60 cy. gen.
1—300 HP McInt. & Sey., 480 V. 60 cy. gen.
1—150 HP Superior, 240 V. 60 cy. gen.
2—125 HP Winton, 240 V. 60 cy. gen.
2— 72 HP Int. Har., 240 V. 60 cy. gen.

WATER TUBE BOILERS
1—1392 HP Springfield 400-lb., Pulverizer
1—1373 HP B. & W. 230-lb., Oil Fired
1— 880 HP B. & W. 250-lb., Stoker
1— 612 HP Stirling 200-lb.
1— 607 HP Wickes 250-lb., Stoker
6— 600 HP B. & W. 200-lb., Stokers
2— 560 HP Erie City 460-lb.
1— 484 HP Springfield 200-lb., Oil-Fired
2— 481 HP Springfield 225-lb., Pulverizer
2— 407 HP Wickes 160-lb., Stokers
2— 405 HP Erie City 160-lb., Stokers
2— 312 HP Stirling 160-lb., Stokers
2— 300 HP Heine 200 lb.
2— 300 HP B. & W. 160-lb.

SYNCHRONOUS MOTORS
1—1700 HP West. 60 cy. 2300 V. 300 RPM
1— 600 HP G.E. 60 cy. 2200 V. 600 RPM
1— 375 HP G.E. 60 cy. 2300 V. 1800 RPM
1— 200 HP Ideal 60 cy. 4000 V. 514 RPM
1— 175 HP West. 60 cy. 4000 V. 514 RPM
1— 100 HP G.E. 60 cy. 2300 V. 240 RPM (Super)
1— 100 HP G.E. 60 cy. 4000 V. 1800 RPM

INDUCTION MOTORS—60 Cy.
4—3500 HP G.E. slip ring 2300 V. 120 RPM
1—2500 HP G.E. slip ring 6600 V. 253 RPM
1—1000 HP West. slip ring 2200 V. 360 RPM
2— 400 HP G.E. slip ring 3800 V. 1800 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
1— 150 HP G.E. slip ring 440 V. 450 RPM
1— 100 HP G.E. sq. cage 2200 V. 900 RPM
1— 75 HP G.E. sq. cage 440 V. 514 RPM

MOTOR GEN. SETS—60 Cy.
1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 200 KW Westinghouse 250 V. DC
1— 150 KW Westinghouse 250 V. DC
1— 100 KW Westinghouse 125 V. DC
1— 75 KW General Electric 125 V. DC

ROTARIES—60 Cy.
2—2600 KW General Electric 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
2— 500 KW Westinghouse 600 V.

FREQUENCY CHANGERS
2—12500 KW G.E. 60/25 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 1875 KVA G.E. 25/60 cy. 300 RPM
1— 1500 KW West. 60/25 cy. 300 RPM
1— 1250 KVA G.E. 25/60 cy. 300 RPM
1— 750 KVA G.E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.
1— 500 KVA West. 110,000-2300 V.
3— 4000 KVA West. 63.5/110-19/33 KV
1— 2500 KVA G.E. 63.5/110-19/33 KV
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000-33000 V.
3— 100 KVA G.E. 66000-6900/11000 V.
3— 1667 KVA G.E. 44000-2300/4000 Y V.
3— 1000 KVA G.E. 44000/22000-480 V.
3— 1000 KVA Al. Ch. 38500/66000-2400 V.
3— 833 KVA Al. Ch. 34460-4800/2400 V.
3— 200 KVA G.E. 33000-2300/4000 Y V.
3— 150 KVA G.E. 22000-2300 V.
14— 75 KVA G.E. 33000-2400 V. New
40— 50 KVA G.E. 33000-2400 V. New
50— 25 KVA G.E. 33000-2400 V. New
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 667 KVA Packard 23000-440 V.
4— 400 KVA Pitts. 22000/11000-2200 V.
3— 200 KVA G.E. 22000-230/460 V.
1—10000 KVA West. 13200-4560 V. 3 ph.
1— 3000 KVA Kuhlman 13800-480 V. 3 ph.
3—1667 KVA Pitts. 13200-2300 V.
4—1250 KVA Pitts. 13500-230-460 V.
3— 200 KVA G.E. 13200-480 V. Pyranol
3— 150 KVA Pitts. 13800-460/230 V.
3— 100 KVA West. 13200-2300 V.
3— 100 KVA G.E. 6900-230/460 V.
3— 75 KVA G.E. 6900-230/460 V.
3— 833 KVA Penn. 4800-240/120 V.
3— 500 KVA Al. Ch. 4150-440 V.
3— 150 KVA G.E. 4150-220 V.

OIL CIRCUIT BREAKERS
2—	600 A. 138 KV G.E. FHKO339	Outdoor
6—	400 A. 37 KV G.E. FHKO136	Outdoor
2—	1000 A. 30 KV Kelman CB76	Outdoor
1—	400 A. 25 KV G.E. FKO136	Outdoor
2—	600 A. 15 KV G.E. FKO37	Outdoor
1—	600 A. 15 KV West. O-221	Outdoor
2—	400 A. 15 KV G.E. FHKO136	Outdoor
3—	400 A. 15 KV G.E. FK132B	Indoor
2—	1200 A. 7.5 KV G.E. FK132B	Indoor
6—	1200 A. 4.5 KV Condit D-12	Indoor

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Special Offerings

TURBO-GENERATORS
1—6000 KW. G.E. 2300/4000 V.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1— 750 KW. 2300 V. Cond.
1— 750 KW. 600 V. Cond.
1— 500 KW. 440 V. Non. C.
1— 500 KW. 125 V. D. C.
1— 375 KW. 440 V. Cond.
1— 200 KW. 2300 V. Cond.
1— 120 KW. 440 V. Non. C.

ENGINE GENERATORS
1—168 KW. 550 V.
2—280 KW. 440 V.
1—600 KW. 2300 V.
1— 75 KW. Uniflow 240 V.

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1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

BOILERS
1—500 H.P. 200# Oil
2—175 H.P. 200# Oil
2—480 H.P. 225#
1—305 H.P. 185# Stoker
1— 90 H.P. Ames Ecom.
4—150 H.P. 150# H.R.T.

MOTOR
1—1250 H.P. G.E. Syn. Engine Type 2300 V.

AIR COMPRESSORS
1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam Driven
1—860, C.F. 50# Diesel
1—1247 C.F. 55# Motor
1—1214 C.F. 100# Motor Driven
1—600 C.F. 350# Steam Driven
1—386 C.F. 100# Steam Driven

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1—3000 GPM 65' Hd Motor
1-1000 GPM Fire Motor Steam
1—750 GPM Fire Pump Steam

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LET US KNOW YOUR REQUIREMENTS
MERCURY ARC RECTIFIERS
1—1500 KW, 250 V—DC, 22000 V—AC, 3 PH.
1—1000 KW, 250 V—DC, 4000 V—AC, 3 PH.
2—1000 KW, 600 V—DC, 4000 V—AC, 3 PH.
2— 300 KW, 250 V—DC, 11500 V—AC, 3 PH.

MOTOR GENERATOR SETS
1—150 KW, 275 V—DC, 2300 V—AC, 3 PH.
1—100 KW, 275 V—DC, 2300 V—AC, 3 PH.

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THREE OF MANY
DESIRABLE DIESEL PLANTS
260 HP, 200 KW DeLaVergne Model VG, 4 cylinder, 14¼x18", 277 rpm, solid injection. 2 or 3 phase, 60 cycle, 2300 volt alternator. Coming off foundation Oct. 15.

300 HP McIntosh Seymour 3-B-33 air inj. 200 rpm 3 cyl. 16½x24. Heavy duty. 2 or 3 phase alternator of any standard voltage. A real engine at attractive price.

375 HP Busch Sulzer modern design of 5 cyl. 360 rpm, air injection diesel 13x17". 312 KVA 250 KW 3/60/2300 V alternator.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
20	Westg.	220	575	CW
20	Allis Chal.	440	1130	
25	Westg.	220	720	CW
50	West.	220/440	860	CW
50	West.	220/440	720	CW
50	West.	220/440	1120	HF
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
100	West.	440	690	HF
150	G.E.	220/440	1200	M-I
200	G.E.	220/440	1200	M-I
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
400	Westg.	2200	435	CW-1214

ALTERNATING CURRENT MOTORS

3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
30	Lincoln	220	600	
35	Lincoln	220/440	720	
35	West.	220/440	575	CS
40	Howell	220	900	SO
40	West.	220/440	720	CS
40	Lincoln	220	900	
45	West.	220/440	850	CS
50	West.	220/440	900	CS
50/150	West.	2200	360/720	CS-954
50	Chandeya.	220-440	1800	
50/32	G.E.	440	800/640	
60	Allis Chal	220/440	1760	
100	West.	440	690	HF
100	Allis Chal.	220	600	
150	Wagner	440	1800	31V
175	G.E.	2200	600	I-12
200	Westg.	2200	900.	

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
2	Star	400/600	SB
2	G.E.	400/1600	RLC
2	G.E.	415/830	RLC
2	Reliance	550/2000	
2½	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
3	Jantz-Llest	650/1950	RI-DC
3	Roth (enclosed)	500/1000	RS
3	G.E.	400/1200	RLC-114
3½	Westg.	400/1600	SA
3½	Westg.	850/1700	
4	G.E.	850/1700	LC-8
5	G.E.	500/1000	
5	Reliance	600/1800	
7½	Westg.	450/900	S0L
7½	Westg.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
15	Reliance	500/1800	
20	Westg.	750/1500	SK-110L
30	G.E.	450/900	RLC
75	West.	400/650	SK-181

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
10	West.	175	1200	V-67
10	West.	230	650	MT-00
15	Cr. Wh.	220	270	SM
15	West.	230	800	HD
25	West.	230	600	MT
32	Shaw	230	485	5L2E
68	G.E.	220	475	
80	West.	230	490	76-A
175	G.E.	230	475	MD

TRANSFORMERS

1 ph. 60 Cy.

No.	Kva.	Pri.	Sec.	Make
1	2	1040/2080	52/104	G.E.
1	2	6600	110/220	G.E.
1	2½	1040/2080	52/104	G.E.
2	3	2200/2100/2000	440/220/110	West.
1	3	2200	110/220	G.E.
1	5	2000/4000	80	West.
3	5	2200	220/440	G.E.
4	5	2200/1100	110/220	G.E.
1	5	2200	110/220	West.
4	5	2200	110/220	G.E.
1	5	2200	110/220	West.
69	7½	1110/2200	110/220	G.E.
29	7½	2200/1100	110/220	West.
8	7½	2200/1100	440/220/110	West.
6	10	2200/1100	220/110	West.
10	10	2200/1100	220/110	G.E.
2	10	2300	220/110	G.E.
1	10	2200/1100	440/220/110	West.
21	15	2200/1100	440/220/110	West.
2	15	2300	230/460	American
3	15	2200	110/220	Packard
3	15	2200	110/220	Cr. Wh.
16	18	220	19½/38½	El Furnace
2	20	1150/2300	115/230	Maloney
2	20	2300	230/460	American
1	20	2300	110/230	West.
2	20	2300/110	440/220/110	West.
2	25	2300	230/460	American
2	25	2300	110/220	West.
18	37½	2400	480/240	G.E.
3	40	2300/1100	220/110	West.
1	40	1100/2200	110/220	Pittsburgh
1	40	2300/1150	113/230	Maloney
2	50	2200	110/220	Packard
1	50	6600	550/440	Allis Chal.
1	50	2200/1100	220/110	West.
2	50	2200/1100	220/110	Maloney
9	75	2400	240/480	G.E.
1	100	2300	230/115	Standard
6	112.5	2400	240/480	G.E.
3	125	2200	220/440	G.E.
2	150	2200/2300/2400	220/230/240	G.E.
3	250	6600/5940	2300	West.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS & ROTARY CONVERTERS—250 V. D.C.

1—5kw. Allis Chalmers 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.

1—7½ kw. West. 1150 rpm. Gen. dir. conn. to 220/440 220/440 v. 3 ph. 60 cy. Induction Motor.

1—10 kw. West SK 1150 rpm. Gen. dir. conn. to 220 v. 3 ph. 60 cy. Induction Motor.

1—15 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.

1—20 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v 3 ph. 60 cy. Induction Motor.

1—25 kw. Triumph 1750 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.

1—25 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.

1—70 kw. West. 250 v. 575 rpm. DC Gen. dir. conn. to 440 v. 3 ph. 60 cy. AC Motor.

1—100 kw. 250/275 v. Rotary Converter ped. type, 6 pole 1200 rpm. complete with switchboard and 3—35 kva. G.E. 2300 v. 1 ph. 60 cy. Transformers.

1—150 kw. West. 250 v 900 rpm Gen dir conn to 200 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.

3—250 kw. Cr. Wh. 250 v. 500 rpm. DC Gens. with 3—250 kva. Cr. Wh. Syn. 220 v. 3 ph. 25 cy. Motors.

125 volts

1—5 kw. Wotton Vert. 88/110 v. DC 1750 rpm. M.G. Set Motor rated at 4 HP 220 v. 1 ph.

1—5 kw. Wotton Vert. 88/110 v. DC 1750 rpm. M.G. Set Motor rated 4 HP 220 v. 3 ph.

1—5 kw. Martin Rotary Converter 70/110 v., DC 1800 rpm. 2 or 3 ph. 60 cy. AC.

1—5 kw. 125 v. 1150 rpm. Allis Chal. Gen. dir. conn. to 3 ph. 60 cy. 220/440 v. AC Induction Motor.

1—10 kw West. 120 v. DC Syn. Converter 1600 rpm. 3 ph. 60 cy. A.C.

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500 KW., 3 ph., 60 cy., 480V. Westgh. non cond. Turbo Generator with board.

937 KVA., 3 ph., 60 cy., 2300V. Gen. Elec. cond. Turbo Generator.

ROTARY CONVERTERS

1—1500KW 250V Westgh complete
2—1000KW 250V Westgh complete

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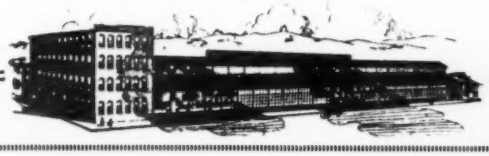

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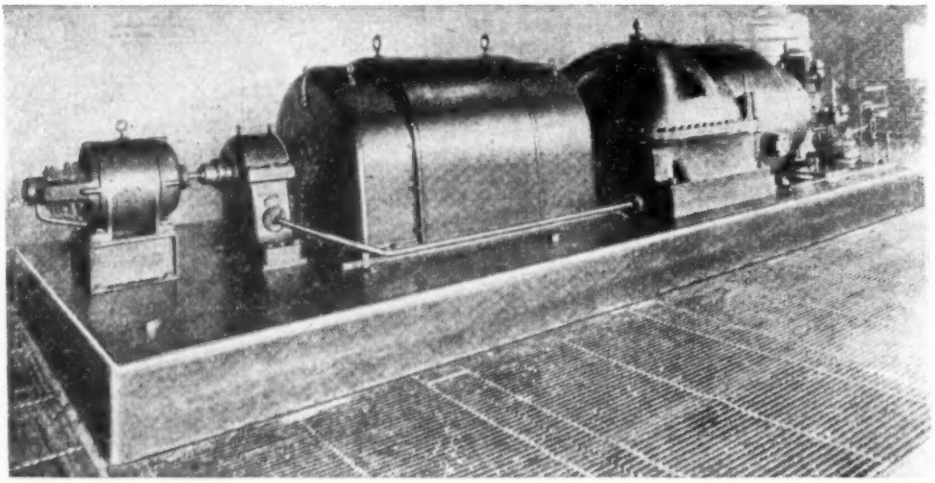

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6250—KVA. G.E. Sur. Cond., 200, 2300#-v.
5000 KVA. G.E., Sur. Cond., 200/400#: 2300/4000-v.
3750—KVA. G.E. Sur. Cond., 200#, 2300-v.
3125—KVA. G.E. Sur. Cond., 200#, 2300-v.
2500—KVA. G.E. Sur. Cond., 200#, 2300-v.
2000—KVA. G.E., Non-cond. 200#, 2300-v.
1875—KVA. G.E., COND. 200#.
1875—KVA, Elliott 300#-G, 2300-v.
1565—KVA. G.E. Sur. Cond. 150#, 2300
1250—KVA, Westinghouse, 200#, 2300-v.
1250—KVA, Allis-C. Non-cond. 150#, 840-v.
1250—KVA. West. Sur. Cond. 200#, 2300
1250—KVA, Allis-C. Non-cond. 150#, 480-v.
937—KVA. Allis-C. Cond. 200#.
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625—KVA, G.E., 200#, 2300-v.
375—KVA. G.E., Cond. 200#, 2300-v.

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3750 KVA Wghse. 600 v. (bleeder)
3750 G.E. 2300 v.
3125 G.E. 480 v. (bleeder)
2500 Wghse. 600 v.
1500 (2) Al. Chal. 600 v.
1580 Wghse 480 v. (bleeder)
937 G.E. 2300 v.
625 KVA. G.E. 2300 v.
500 (3) G.E. 240 v.
375 G.E. 2300 v.
312 Elliott-Kerr 480 v.
312 Moore (bleeder & Non-con.)

SPECIAL

625 KVA. Allis Chalmers 3 phase, 60 cycle, 2300/480 volt alternator, with Terry non-condensing turbine, 10 to 35 lbs. back pressure.

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312 KVA. G.E. 3-60-480 volt; with 21x25 Chuse uniflow engine, seen operating.
187 KVA. G.E. 3-60-480 volt; with 18x21 Chuse 4 valve engine, seen operating.
150 KW. G.E.-Skinner uniflow engine.

A.C. TURBINE UNITS
NON-CONDENSING

625 KVA. Al. Chal.-Terry.
115 KVA. Wghse.-Studevant (New)
50 KVA. G.E.-Terry.

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PUMPS (MOTOR DRIVEN)
COMPRESSORS
MOTOR GENERATOR SETS

WAGNER

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M-G SETS

300 KW Gen. Elec. type MPC gen. DC 170 volts 1760 amp. coupled to 450 HP G.E. MPC motor DC 250 V. 1150 RPM (can furnish A.C. drive).
217 KVA Whse AC gen. 3-60-120/208 V. coupled to 225 HP type SK motor DC 230 V. 1200 RPM, 3 brg. unit, like new, also operates AC to DC, with panels.
100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage 1-K motor 3-60-2200/4000 V.—1200 RPM.
50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440 V. 1800 RPM.
35 KW Gen. Elec. DLC gen. DC 250 V. to 50 HP AC motor 3-60-220/440 V.
30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v. 1160 RPM, late style 3 brg. unit.
19 KW Gen. Elec. CD95 gen. DC 65 V. 300 amp. to 30 HP G.E. KT motor 3-60-220/440 V.
Others available — special units built to order

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
125	Fair. Morse	TRC	500	900
100	Sprague cradle dynamometer		250	1650/2500
75	Fair. Morse	TR	230	525
75	Whse.	S13	125	475
60	Triumph	interpole	230	900
50	G E. Sprague	LC	250	700/2000
50	Whse.	SA	230	450/1350
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
40	Whse. (2)	SK158	230	575
35	Whse.	SK130	230	1100
30	Allis Ch.	E100	230	1800
30	Sprague	LC	230	600/1200
30	Sprague	dynamom	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Gen. Elec.	RF12	230	400/1200
20	Gen. Elec.	DLC	230	500/1500
20	Whse.	SK100L	230	900

QUICK SHIPMENT FROM STOCK

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	200	Gen. Elec.	I-K	600
1	150	Gen. Elec.	KTP549	1800
1	150	Whse.	CS	1200
1	60	Gen. Elec.	KT343	1200
1	50	Cr. Wheeler	20R	1800
1	50	Whse.	CS	900
1	50	Gen. Elec.	KT546	600
2	50	Gen. Elec. vertical	KT	1200
2	40	Allis Ch.	AN	1200
1	40	Gen. Elec	I-K	600
1	40	Howell 440 v.	SCBB	3600
1	40	Gen. Elec.	I-K	1200
2	30	Allis Ch.	AN	1200
1	30	Allis Ch.	AN	600
6	30	Allis Ch.	AN	900
2	30	Gen. Elec.	KT326	1200
12	25	Gen. Elec.	KTR526	1200
3	25	Whse. New	CS365	1800
1	25	Gen. Elec.	KT322	1200
2	25	Allis Ch.	AN	900
1	25	Allis Ch.	AN	600
1	25	Whse.	CS	720
4	20	Allis Ch.	An	900
3	20	Whse. New	CS364	1800
2	20	Gen. Elec.	I-K	1200
3	20	Whse.	CS	900
1	20	Ideal	AA	1200
3	20	Gen. Elec.	KT312	1200

25 CYCLE MOTORS

H.P.	Mfr.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
300	Whse.	CW sl. rg.	500
150	Whse.	HD sl. rg.	500
150	Gen. Elec. 2200 v.	MT359 sl. rg.	1500
100	Whse.	CCL sq. cg.	500
100	Gen. Elec.	I-K	750
75	Whse.	CS	750
75	Cr Wheeler	75R	500
50	Allis Ch.	ANY sl. rg.	1500
25	Gen. Elec.	I-K	1500

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
750	Allis Ch.		220/440	1200
350	Gen. Elec. 3 brg.	ATB	220/440	600
300	Whse.	ped.	220/440	900
250	Gen. Elec. 1-brg.	ATI	220/440	600
75	Ideal	SMS	220/440	1200
60	Gen. Elec.	TS	220/440	900

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 200 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	350	Whse. 2200 v.	CW	720
1	300	Burke	EMV	225
1	300	Whse.	HF	400
1	300	Gen. Elec.	MT416	450
1	300	Gen. Elec.	I-P	720
1	250	Gen. Elec.	I-M	600
1	200	Gen. Elec.	I-M	720
1	175	Whse.	MW	450
1	175	Lincoln	IXV	600
2	150	Allis Ch. 3 brg.	ANY	514
1	150	Gen. Elec.	MT562	720
1	100	G.E. 2200 v.	I-E13A	1806
1	100	Gen. Elec. 3 brg.	I-M	450
1	100	Gen. Elec.	I-M	600
1	75	Gen. Elec.	I-M	600
1	75	G.E. 2200 v.	I-E13	1800
1	65	P. & H. b. b. Int.	CA16	900
1	60	Whse. 2200 v.	CW657	1800
2	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. b. b. 2200 v.	ARY	900
1	50	Gen. Elec.	I-M	600
1	40	Gen Elec. 2 ph.	MQ536	900
1	40	North'n	HW35A	1200
2	40	Gen. Elec.	MT532	1200
1	40	Fair Morse b. b.	HV	900
1	40	Whse.	CW	900
2	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	35	Fair Morse, b. b.	HV	1800
1	30	Northwestern b. b.	HW404	1800
2	30	Allis Ch.	ANY	900
2	30	Whse. enclosed	MA	600

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
75	Whse.	S	125	600
50	Cr. Wheeler	CC	125	1800
40	Whse.	SK	250	720
35	Gen. Elec.	DLC	250	900
35	Whse.	SK130	250	1150
30	Lincoln b. b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	LC	250	900
20	Whse.	SK	250	1200
19	Gen. Elec. 300 amp.	CD	65	1200
16	Cr. Wheeler	CCD	125	415

ALSO IN STOCK . . . OIL SWITCHES BLOWER & FANS . . . SPEED REDUCERS . . . 500 NEW MOTORS

60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
500	Gen. Elec. 3 brg.	ATB	2300	450
300	Gen. Elec. 3 brg.	ATB	240/480	600
300	Whse.	ped.	240/480	900
300	Elec. Machy. 3 brg.		240/480	720

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2 — 300 K. W.
BURKE 250/125 volts
Direct Current
SYNCHRONOUS MOTOR GENERATOR SETS

SPECIFICATIONS

2—300 K.W. Burke 4 bearing Synchronous Motor Generator Sets, 3 wire, 250/125 volts Direct Current, Type CB67, 900 R.P.M. 1200 Amperes, Compound Interpole, Serial Nos. 136014 and 136129 on common sub-base direct connected to 450 H.P. 4160 volt, 3-phase, 60 cycle, .85% P.F. Synchronous Motor, type AC88, Serial Nos. 136010 and 136011.

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SLIP RING MOTORS

3-HP., 60.CY.

HP	Volts	Make	Speed
400	440	G.E.	360
300	2200/440	G.E.	600
200	440	G.E.	450
300	440	Al. Chal.	900
300	2200	G.E.	1800
250	2300	G.E.	600
250	440/550	G E.	600
250	440	Whse.	450
250	550	Al. Chal.	900
200	2200/440	G.E.	1200
200	2200/440	G.E.	600
150	440	G.E.	1800
150	4000/2300	G E.	1800
150	2200/440	G.E.	600
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
125	2200	G E. (New)	1800
100	440/220	G.E.	1800
100	220/410	G E.	720
100	220/440	G E.	900
100	440/220	G.E. MTC	900
100	550	G.E.	1900
75	440/220	Whse.	720
75	550	G E.	900
60	2200	G.E.	900
40	2200	Whse.	900
40	2200	G.E.	1200

SYNCHRONOUS MOTORS

3-HP., 60.CY.

300	440/220	Al. Ch.	600
200	2200	Whse.	900
110	440	Whse.	900
100	2200/550	Al. Ch.	1800
100	440/220	G.E.	360
75	440/220	G.E.	720

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK. 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—1200 ampere, type D 12, Condit, 7500 volt, 3 pst, hand-operated.

1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt.

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60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460.
3—250 kva., Whse., 13,800-460.
3—250 kva., G.E., H KDD, 13200-2300/575 V.
3—200 kva., G.E., type H, 34500-2300 V.
3—150 kva., G.E., H-KDD 13200-2300.
3—150 kva., Al. Ch., type OISC 10400-2400.
3—150 kva., G.E., H-KS, 2400-240/120 V.
2—150 kva., G.E., HTQ, 4150-240/480 V.
3—100 kva., Whse., SK, 4200-460/230 V.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., G.E., type H-KR 6600/11430Y-2300 V.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230-115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G E.	IK	1200
500	440/220	G.E.	IK	900
400	2200/440	Whse.	CS	720
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
200	440/220	G.E.	IK	900
200	440/220	G.E.	IK	1200
150	440/220	G.E.	KT	720
150	440, 220	Whse.	CS	514
125	440/220	G E.	KT	1800
125	440/220	G E.	K	514
125	440/220	G.E.	KT(Vert).	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
74	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

1—75 KW, 250 V. 850 RPM, conn. to 110 HP, 440/220 V. Sq. Cage Motor.
1—50 KW, 250 V. 850 RPM, Whse. conn. to 75 HP, 440/220 V. 3 ph. 60 cy. Sq. Cage Motor.
1—50 KW., 125 V., 1200 RPM. Whse conn. to 75 H.P. 2200/220 V.; 3 ph., 60 cy., Sq. Cage Motor.
1—25 kw, 250 V, 1800 rpm, GE, conn. to 25 hp, 440 volt, 3 ph., 60 cy., Sq. Cage

A.C. GENERATORS

1—375 kva, 514 rpm, 480/240 V, GE
1—250 kva, 600 rpm, 440/220 V, Al. Ch.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 96 kva., 360 r.p.m., 480/240 V., G.E.
1—62½ kva., 1200 r.p.m., 2200 V., G.E.

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STEAM PUMPING ENGINES

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1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20x40x14¾x36 with waterworks type con.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All fine cond.
1—Platt Iron Wks. Cr. Comp. C&FW Meyer Valve Gear Cond. 1000 GPM. Size 14x28x9¼"x18.

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Birch Valves for all types of reciprocating pumps.

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1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End-Gate-Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt, 100#

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2—DeLaval Steam Turbines, steam pressure 225#, exhaust pressure 2#, 4000 R.P.M., with reduction gear to 730 R.P.M.

Large Assortment of DC and 25 Cycle Motors, from 1 to 3750 H.P.

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STEAM PUMPS—Duplex - Simplex Reconditioned and guaranteed

BOILERS—stacks—Engine Generators—condensers.

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500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

500 KW G.E. SYN. 600 V. 2200/4000 A.C. 720 RPM
300 KW WEST. SYN. 250 V. 2300/4000 A.C. 900 RPM
300 KW WEST. SYN. 250 V. 4000/6600 A.C. 900 RPM
200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM
150 KW WEST. SYN. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK CO.

Incorporated

502 Grant Building, Pittsburgh, Pa.

FOR SALE

1—100 GPM Worthington 125 lbs. centrifugal fire pump direct connected on base to 100 HP Westinghouse Type CS 3/60/2300 1800 RPM motor.
1—IR cross compound 300 RPM air-compressor cylinder 11" and 7" by 10" belt-driven by 60 HP Westinghouse 3/60/2300 volt slip ring motor.
1—IR Type 10 cross-compound steam driven air-compressor air-cylinder 12" and 7½" by 12" 100 lbs. pressure.
1—250—HP Casey-Hedges water tube boiler 150 lbs.
1—500 KW GE steam turbine 150 lbs. steam condensing direct connected to 500 KW 3/60/2300 volt 3600 RPM GE turbo-generator with wheeler surface condenser.
3—728 HP each Erie City boilers Type No. 6-S vertical bent tube water tube. ASME code 180 lbs. with individual stacks.
1—GE 1250 KW 3 stage steam turbine 150 lbs. gage surface condenser direct connected to GE 3/60/2300 volt 1250 KW turbo-generator 1.00% P.F.
1—GE 600 KW 175 lbs. form B 4 stage surface condenser steam turbo direct connected to GE 3/60/2300 volt 600 KW pf. 8 turbo-generator.

RALPH H. ROGERS & CO.

306 Millsaps Bldg.
Capital & Roach Sts. Jackson, Miss.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 phase, 25 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	G.E.	KT327	750	1781884
15	Allis Chal.		720	84242
15	G.E.	I-K	750	685100
15	West.	CCL	1500	816324
20	West.	CS	715	2691183
20	West.	CS	730	1949877
18	Otis	15	750	104787V
20	Allis Chal.		720	3K28825
20	Wagner	BP22T	750	119028
20	Reliance		720	Z20194
25	Allis Chal.	AR20A	750	220-A-623-4209-3
25	G.E.	I4	750	292596
25	Rob. & Myers	K	720	P515362
25	Triumph	TR12	750	C14248.
30	Wagner	22VBMS	710	127097
30	Wagner	22VBM3	725	171477
30	West.	CCL	710	602618
30	G.E.	KT327	1440	2302731
40	West. (2200 v.)	CCL	710	854121
38	Otis	AC 750/187½		70002Y
38	Otis	AC 750/187½		70061Y
40	Wagner	22TLBP	1425	318004
40	West.	CCL	710	1032102
50	G E.	I-K	1455	4015021
75	West.	CS	735	2207524
100	G E.	KT553	1500	4820366
100	West.	CCL	480	808349
150	G.E.	I-K	363	2246835
150	G E.	I-K	365	2246834
150	G E. (2200 v.)	KT557Y b.b.	1460	5227355
150	G E. (2200 v.)	KT557Y b.b.	1470	5269756
150	G E. (2200 v.)	KT557Y b.b.	1460	5227354
225	Elec. Mach. (2200/440 syn.)		500	504129
1150	G.E.	ATI (syn.)	375	695425

MOTOR GENERATOR SET

1—125 KW Ridgeway 250 V. DC 1200 RPM, direct connected to 180 HP. Ridgeway Motor 3/60/440 Volts 1200 RPM DC. Panel and Starting Compensator.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

TRANSFORMERS

3—150 KVA General Electric Type 11, Form KS, 2400 Volts Primary 120/440 Volts Secondary.

REBUILT MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Crocker Wheeler		600	131413
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	944593
20	Westinghouse	CS	1200	2160590
20	Westinghouse	MS	1200	1058826
20	Westinghouse	MS	1200	1246745
20	Westinghouse	MS	1200	1058827
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	1930150
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Armor	BB	720	4343
30	Crocker Wheeler		720	17270
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43176
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	General Electric	I-K	1800	68511
40	General Electric	I-K	1800	77017
40	General Electric	I-K	1800	73316
40	Westinghouse	MS	1800	1506800
40	Westinghouse	MS	1800	1051548
40	Westinghouse	MS	1800	1056802
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	Westinghouse	CS	1800	1949877
50	General Electric	14	1800	181444
50	Reliance		1800	Z20194
50	Allis Chalmers		1800	3K28825
60	Westinghouse	CS	900	4884402
60	Reliance		1200	R11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CS	900	2207524
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	General Electric	KT562	720	Ball bearing
125	Westinghouse	CS	1200	2318625
150	General Electric	KT568	450	
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438386
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	720	122809 (2200 v.)
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	KT568	514	
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	KT568	600	
250	General Electric	I-K	600	2246834
300	General Electric	KT568	720	
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845
400	General Electric	KT568	900	

SLIP RING MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
20	Westinghouse	CW644C	575	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	1558408
40	Westinghouse	CW748	690	4406823
40	Westinghouse	CW748	690	4406825
40	Westinghouse	CW748	690	4406821
40	Westinghouse	CW748	690	4406819
40	Westinghouse	CW748	690	4405824
40	Gen. Elec. (new)	M.445	1200	Ball Bearing
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

MAGNETIC CONTACTOR

400 HP. Gen. Elect. Type CR. 7006. Form D12D. 3/60/440 Volts.

CURRENT LIMITING REACTOR

60 KVA. Westinghouse 1 Phase 25 Cycle 6.2% on 12000 Volt Lines.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR-GENERATOR SETS

KW	Make	DC Volts	AC Volts
1000	Wtg.	275 Ind.	3/60/4100
750	Elliott	275 Syn.	3/60/440
300	G E.	275 Syn.	3/60/2200
225	Ideal	115 Syn.	3/60/2200
200	G E.	250 Syn.	3/60/440
150	G E.	250 Syn.	3/60/2300
75	G.E.	3 wire Syn.	3/60/480
75	G.E.	125 Ind.	3/25/220
75	G.E.	125 Ind.	3 25/440
90	Wtg.	110 75 h.VA	3, 60/2300
60	Al. Ch.	110 Ind.	3/60, 2300
50	G.E.	115 Ind.	3/60/440
35	G.E.	250 Ind.	3/60/220
35	Century	240 Syn.	3/60/240

SLIPRING MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
800	Wtg.	CW	6600	507
800	Al. Ch.		440	600
600	Al. Ch.	ANY	2200	1180
600	Wtg.	CW	2300	343
350	Wtg.	CW	220	700
350	G E. 3b.	IM	2200	600
300	G.E.	IM	2200	514
300	G.E.	MT	2000	450
200	F. Morse		440	600
300	Al. Ch.		440	705
250	G.E.	IM	440	720
250	G.E.	IM	2200	600
150	Al. Ch.	ARY	440	880
150	Wtg.	CW	440	600
100	G E.	IM	2200	1800
100	Wtg. vert.	CW	2200	1160
100	Ideal	AV	2200/440	720
100	Westg.	HF	440	230
75	G.E.	MT	220	1800
75	G.E.	MT	440	860
60	Al. Ch.	ARY	220	690
50	G.E.	MT	440	1800
50	G.F.	IM	220	900
50	Al. Ch.	ARY	220	690
50	G.F.	MT	2200	600
50	Wtg.	CW	440	870
40	Wagner	THR	440	1750
40	Al. Ch.	ARY	220	1160
30	G.E.	MT	440	1150
30	Wtg.	CW	220	865
35	G.E.	IM	220	1140
25	G.E.	IM	220	855

This is a partial listing only.

300 KW Engine-generator

300 KW 375 KVA, General Electric, type TRE, 3 phase, 60 cycle, 480 volts, a.c. generator, 40-deg. 125% load 2 hrs. 55-deg., direct-connected to—Erie-Ball engine, non-condensing, 4-valve, steam pressure 125 lbs. maximum.

SQUIRREL CAGE MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
150(6)	Al. Ch.	AR	440	900
150	Wtg.	CS	2200	720
150	Al. Ch.		440	570
150	G.E.	IK	440	575
100	Wtg.	CS	2200	1750
100	Wtg.	CS	440	900
100	Wtg.	CS	2200	870
75	G.E., tot enc	KF	440	3575
75	G.E.	KT	2200	1800
75(9)	Al. Ch.	AR	2200	1765
75	Westg.	CS	2200	870
75	G.E.	KT	440	870
75	Wtg.	CS	220	600
75	Al. Ch.		440	385
60	G.E.	KT	440	865
60	Wtg.	CS	220	435
60	Wtg. vert.	CS	2200	1750
50	G.E.	KT	440	600
50	G.E.	KT	440	900
50	G.F.	IK	440	1200
40	G.E.	KF	2200	1745
40	G.E.	KT	220	1745
40	Wtg.	C	440	850
40	Al. Ch.		440	850
40	F. Morse	H	2200/440	720
40	Al. Ch.		440	570
35	G.E.	IK	440	1200
35	Wtg.	CS	2200	1175
35	G.E.	KT	220	900
35	G.F.		2200	900
35	Al. Ch.		440	680
35	Al. Ch.		440	480
30	G.E.	KT	220	860
30	G.E.	KT	440	900
30(2)	Wtg.	CCL	220	840
30(2)	Al. Ch.		440	860
30	G.E.	KT	220	600
25	Ideal	AA80	220	1740
25	Cr. Wh.	118Q	440	1150

This is a partial listing only, have NEW from ¼ to 60 hp right in stock.

A. C. GENERATORS

KW	Make	Volts		Speed
2500	Wtg.	6600		450
1250	Ideal	2200		1200
300	G.E.	480		900
200	Westg.	2400		900
75	Burke	AC16	240	1200
72	F. Morse	AB	440	900
75	G.E.	ATB	230	1200
60	F. Morse	D	2300	300
8	G.E.	ATI	240	900

TRANSFORMERS

KVA	Make	Prl. V.	Sec. V
5—1000	G.E.	13200	2300
2— 667	Moloney	13200	460
3— 500	G.E.	33000	480
1— 100	G.E. 3 ph.	9000	230
3— 75	Wtg.	3810	244/122
2— 50	G.E.	2200	440/220
1— 20	G.E.	2200	220/440
1— 15	G.E.	1050/2100	2200/288
1— 15	G.E.	2400	120/240
1— 7½	G.E. 3 ph.	2200/3810	220/440
1— 7½	G.E.	1100/2200	220/440
1— 6	Kuhlman	100	20
1— 5	Sorgel	140	220
1— 5	G.E.	1100/2200	110/440
1— 5	G.E.	1100/2200	220/440
5— 3	G.E.	440	110/55
1— 3	Moloney	1150	115/230

BOILERS

502 HP B & W Stirling water tube ASME, 200 lbs. complete with pulverizer, blowers, fan, etc.

2—800 'Twin setting' B & W Stirling, ASME, 200 lbs. all complete, excellent condition.

2—510 HP Heine straight tube, 200 lbs. less firing equipment.

2—520 HP B & W sectional header straight tube water tube, 200#.

FREQUENCY CHANGER

1—1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph. 60 cy. 460 volt, 300 RPM, 1570 amps, 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir/conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph. 25 cy. 460 volts, 300 RPM, 1570 amps, 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

SYNCHRONOUS MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
5000	Wtg.	conds.	2300	900
2100	G.E.	ATI	4600	514
3000	Al. Ch.	conds.	2300	900
1000	Wtg.		440	900
750	Al. Ch.		440	1200
750	G.E.	conds.	550	900
500	G.E.	TS	2200	720
500	G.E.	TS	2200	600
500	G.E.	TS	2300	450
300	G.E.	conds.	480	900
270	G.E.	ATI	440	600
150	Burke	S1375	2200	600
100	Cr. Wh.		240	900
75	G.E.	ATB	220	1200
50	El.M.	.8	240	1200
10	G.E.	ATI	240	900
5	G.E.	K324	220	1800

reluctance type

VARIABLE SPEED D.C. Motors

HP	Make	Type	Speed
100	G.E.	C	1100/1200
25	Wtg.	S9	550/780
25	G.E.	DLC	500/1000
20	Wtg.	SK113	500/1000 (4)
15	G.E.	RC16	500/700
15	G.E.	CE	650/950
14	G.E.	C	700/1400
12	Wtg.	SK80L	500/1000 (2)
10	El. Dyn.		600/1200
12½	G.E.	C	700/1400
4	G.E.	C	800/1400
5	Burke	AM12	500/1500
5	Burke	WAM12	650/1950

WE ARE ALWAYS IN THE MARKET FOR ALL TYPES OF GOOD MODERN ELECTRIC MOTORS, MOTOR-GENERATOR SETS GENERATORS, TRANSFORMERS, AND OTHER ELECTRICAL EQUIPMENT. SEND US YOUR LISTS FOR BEST CASH OFFERS.

CHICAGO ELECTRIC CO.

1320 W. CERMAK RD. CANAL 2900

CHICAGO 8, ILL.

SEARCHLIGHT SECTION

BOILERS

1—1392 HP Springfield sectional Header 400#.
1—600 HP Wickes low head 250# with underfeed Stoker.
2—1040 HP Heine, 210# pressure.
4—768 HP Stirling, 210# pressure.
7—570 HP Heinie, 210# pressure.
2—600 HP Stirling, 200# pressure, new tubes, rebuilt.
1—500 HP Stirling, 200# pressure, new tubes, rebuilt.

TURBINES

3—6000 KW Westinghouse 3600 RPM 3/60/2300 volts Condenser, all auxiliaries.
2—15,625 KVA General Electric Condensing Turbines.
1—3750 KVA General Electric Condensing Turbine.
1—3000 KVA General Electric Condensing Turbine.

DIESEL ENGINES

3—300 KVA Fairbanks-Morse Full Diesel Engines.
3—200 KVA Fairbanks-Morse Full Diesel Engines.
1—330 KW Busch Sulzer 3-60-2300 Volt, all auxiliaries.
4—Busch Sulzer Full Diesel direct connected 1335 KW AC generator, rebuilt and guaranteed.
1260 KVA Nelseco engine generator.

ENGINE GENERATOR SETS

1—750 KVA Corliss Engine Generator Set.
1—375 KVA Harrisburg Uniflow Engine.
1—700 KVA Ames Uniflow Engine Generator.
1—150 KW Skinner Uniflow Engine Generator Set A.C.
1—1060—KVA Nordberg Uniflow Engine Generator.
1—500 KW Non Releasing Corliss, 3-60-240 volts.

MISCELLANEOUS

90,000 pound Cochrane Hot Process Lime & Soda Softener.

2500 HP Cochrane Open Feed Water Heater.

1—10' x 15' Illinois Forced Draft Chain Grate Stoker.

2—6 Retort Taylor Stokers. First-Class condition.

2—300 HP Westinghouse Underfeed Stokers, rebuilt.

1—800 HP Hoppes open feedwater heater.

2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.

1—232 GPM Centrifugal Boiler Feed Pump, turbine driven, 1200 ft. head.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

WURTH for "WORTH"!

A.C. GENERATORS 3 PHASE—1 PHASE 15 TO 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 WD • HIGH CYCLE GENERATORS

Send for Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY

Motors, Generators, Alternators, Frequency Changers.
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

FOR SALE

New and guaranteed used steel pipe in large quantities up to 36" inclusive, also, new and guaranteed used boiler tubing, steel buildings, steel and wood tanks, valves, fittings and pumps.

Jos. Greenspon's Son Pipe Corp.
NATIONAL STOCK YARDS
St. Clair County, Illinois

4000 K.V.A. TURBO

4150 V, 60 Cy, 3 PH. WITH SUR. COND.
2— 50 KW 480 V, 60 CY, 3 PH. OIL ENG. SETS
1—250 KW 480 V. ENG. SET, 4 VALVE
1—150 KW 480 V, ENG. SET
ROSS POWER EQUIPMENT CO., Indianapolis 4, Ind.

We furnish BOILERS, TURBO GENERATORS STEAM & DIESEL ENGINE SETS, COMPRESSORS All sizes, types. Modern, at right prices.

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York, N. Y.

-TRANSFORMERS-

3—833 KVA 13200-240/480 V.
3—667 KVA 6900/12000Y-2300 V.
4—500 KVA 6900/11950Y-2300 V.
3—333 KVA 69300-480 V.
3—200 KVA 22000/11000-230/460 V.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M — Since 1912 — CINCINNATI 27, OHIO

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

PRICED TO SELL FAST ! ! !

5000 KW Westinghouse Turbo Generator Set, 13,800 V., 25 Cy.
(Write for 'illustrated bulletin')

IRON & STEEL PRODUCTS, INC.
13438 S. Brainard Ave., Chicago 33, Illinois.
"Anything containing IRON or STEEL"

BOILERS

NEW and USED

All makes & sizes for prompt shipment

6—500 H.P. Heine 200#

Special Offer
400-HP....175 lbs.
Stirling Boilers

J. F. DAVIS CO.
122 S. Michigan Ave. — CHICAGO
Telephone Harrison 0755

BOILERS

10 to 1000 H.P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 2-5740

MACHINERY—FOR SALE

1—125 KW synchroneous Motor Generator Set
1—250 HP Slip Ring Motor—Rebuilt
1—24"x36" Jaw Crusher with Motor
1—100'x220' Steel Bldg. with O.E.T. Crane
1—5 Ton P&H, 60' Span O.E.T. Crane
1—50 & 75 HP Code, 175# Horiz. Boilers
1—340 KW Westge. Gen. D/C 4-Valve Engine
2—250 HP ASME Code Locomotive Type Boilers

H. & P. MACHINERY COMPANY
6719 Etzel Ave. — St. Louis 14, Mo.

New "SEARCHLIGHT" Advertisements

received by October 12th will appear in November issue, subject to space limitations.

Departmental Staff
POWER
330 West 42nd St., New York 18, N. Y.

IN STOCK!

ELECTRIC MOTORS

D.C.—230 V. 10 to 15 H.P.
ALL MAKES AND TYPES

D.C.—115 V. 1/3 to 25 H.P.
ALL MAKES AND TYPES

Induction Type—220 V.—2 Ph.—60 Cy.

1—5 H.P. Burke—Type EB 5—1130 RPM.
1—5 H.P. Burke—Type EB 75—900 R.P.M.
1—7½ H.P. Robbins & Myers—TYPE K—850 R.P.M.
1—10 H.P. Burke—Type EM 1.2—900 R.P.M.
2—20 H.P. Burke—Type EM 3—1200 R.P.M.
1—20 H.P. Crocker Wheeler—1170 R.P.M.
1—35 H.P. Burke—Type EM—4.5—900 R.P.M.
1—50 H.P. Burke—Type EM—4.5—1200 R.P.M.
1—150 H.P. West—Type CW—1765 R.P.M.

GENERATORS

One 250 K.V.A. and one 300 K.V.A. Crocker Wheeler Generators direct connected to Skinner Tandem compound engines—480 volts—3 phase 60 cycle, switchboard, instruments, piping.

One 300 K.W. General Electric Generator, 2300 v., 3 ph., 60 cy., direct connected to Curtis Steam Turbine, 175 lbs. pres.—3600 R.P.M. with 15 K.W. G.E. direct connected exciter.

PUMPS

One Quimby 4 stage Centrifugal pump direct connected to 75 H.P. G.E. motor—220 volts—3 phase, 60 cycle, 1750 R.P.M.—500 G.P.M. 150 lbs. pressure.

One American Well 2 stage Centrifugal pump direct connected to 30 H.P. G.E. motor, 220 v., 3 ph., 60 cy., 1750 R.P.M. 200 ft. head complete with magnetic starter and safety switch.

FEED WATER HEATERS

One Goubert feed water heater with brass tube—330 sq. ft. heating surface.
One Cochrane feed water heater, 54" dia. x 48" long—1000 H.P. capacity.

BOILERS

One 444 H.P. Union Iron Works, water tube steam boiler 200 lb. working pressure, pulverized coal or oil fired.

STEAM ENGINE

40 H.P. Nagle vertical steam engine, Class F, 12" cylinder, 12" stroke, flywheel 54" x 12½".

EMSCO EQUIPMENT CO.
EMIL A. SCHROTH, Owner
50 Hyatt Ave. Newark 5, N. J.
Phone Mitchell 2-3536

DIESEL UNITS

1550 HP. Elec. Boat Engine 480 rpm.
480 KW Cooper Bessemer 2300 V.
300 KVA Fairbanks Morse 2400 V.
250 KW Ingersoll Rand 2200 V.
250 KW Busch Sulzer 240 V.
250 H.P. Busch Sulzer 257 rpm. Engine.
192 KW McIntosh Seymour 2300 V.
150 H.P. Otto 277 rpm. Engine.
125 KW Cummings 220 V.
100 KW Busch Sulzer 2300 V.
75 KW Superior 2300 V.
75 KW Wolverine 220 V.
50 KVA Fairbanks Morse 2300 V.
12—11,500 & 20,000 Gal. Steel Tanks.
175 gal. hr. T. Jones oil heater.

R. C. STANHOPE, INC.
60 East 42nd St., New York, 17, N. Y.

APPLICATION ENGINEERS

2—200 KW Syn. M. G. Sets 440 AC—250 DC
1—3000 KW 120 RPM slip ring motor and control
1—360 HP 240V AC F. Morse diesel set.
90 & 40 KW 240V AC uniflow engine sets
Complete diesel plant (3) 160 HP 240 V AC sets.
Inquiries receive prompt attention.

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1—200 HP Westinghouse, 3-60-2200V, 600 RPM syn. #4956114, direct conn. exciter and starter
2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM
2—100 HP, General Electric, type 1-17, from K, 3-60-440V, 350 RPM
1—100 HP Westinghouse, type CCL, 3 ph. 60 cy., 2200 V. 1750, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph. 60 cy., 220V, 580 RPM slip ring.
1—100 HP General Electric 3 ph. 60 cy. 4000V. 720 RPM syn., type TS with direct connected exciter
1—150 HP Allis-Chalmers 3-60-440V. 450 RPM slip ring
3—100 HP, General Electric, 3-60-440V, 450 RPM sq. cage
4—75 HP G. E. 3-60-2300V, 400 RPM, type I, sq. cage
1—75 HP General Electric, type KT, frame 582, 3-60-440V, 450 RPM
1—75 HP Fairbanks-Morse, type H, frame 105C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type 1Q, 3 ph. 60 cy. 3 phase, 440V, 600 RPM Squirrel Cage
2—75 HP Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors
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1—50 KW factory built m-g set, 125 Volt Ideal 900 RPM driven by 75 HP, sq. cage 220/440 V. motor
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1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 556 slip ring motor
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring
1—50 HP Triumph 3-60-440V, type C12 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers, 3-60-440V, 720 RPM, slip ring
61—50 HP General Electric, 3-60-440V, 690 RPM, MT 546, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP General Electric type I-M, 3 ph. 60 cy. 440V, 720 RPM slip ring
1—45 KVA Fairbanks-Morse, 3 ph. 60 cy. 220 V, 1200 RPM alternator
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1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC driven by 75 HP, 3 phase, 60 cycle, 220 volt 1165 RPM motor
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1—100 HP. same description as above

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NEW

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3500	140′	Kingsford	Centrif
2400	55′	American	Centrif
1100	220′	Allis-Chalm	Centrif
1500	160′	De Laval	Centrif
400	625′	LeCourtenay	Centrif
250	525′	LeCourtenay	Centrif
400	350′	Goulds	Triplex
300	500′	Goulds	Triplex
175	500′	Goulds	Triplex
500	175′	Blackmer	Rotary
450	231′	Kinney	Rotary
300	150′	Viking	Rotary
1000	460′	Knowles	Steam
750	460′	Snow	Steam
500	100′	Foster	Steam
2000	50′	Lawrence	Sump
300	231′	Gardner	Plunger

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K.W.	Make	Volts	Type
25	Green Eng.	220 D.C.	Belt Drive
100	Ames	240 D.C.	dir. dr. Eng.
75	Ames	240 D.C.	dir. dr. Eng.
17	Sturt Turbine	110 D.C.	Direct Drive
7½	Sturt Turbine	110 D.C.	Direct Drive

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100 Northwest	220	1750
25 Roth	230	1750
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C.F.M.	Pressure	Make	Type
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500	60	Ing Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
140	125	Curtis	Vert. Dup.
100	125	Ing Rand	Vert Dup.
28	5000	Norwalk	4-Stage

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1800	5¼ lbs.	Ing Rand	Motor dr.
1350	24 oz.	Spencer	Motor dr.
900	10½ lbs.	Ing Rand	Motor dr.
900	5¼ lbs.	Ing Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24-45 oz.	Spencer	Motor dr.
450	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

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C.F.M.	St. Pres.	Make	Type
100 60000	¼"-5"	Buffalo	Various
100 15000	¼"-16 oz.	American	Various

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C.F.M.	Press	Make	Type
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
500	3 lbs.	Roots	Belt dr.
235	1 lb.	Fuller	Direct dr.
110	15 lbs.	Beach R	Belt dr.

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350	27 in.	Worth	Belt dr.
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100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.
100	20 in.	Nash	Direct dr.

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50	West.	220	850	CCL
50	West.	220	570	CS
40	G. E.	220	870	342
30	Wagner	220	850	Sl. rg.

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Sq. Cage—220/440 V. 60 Cy. 3 ph.

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2	100	G.E.	IK	1800
1	150	West	CS	1800

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1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200

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1	50	West.	SK	500/1500
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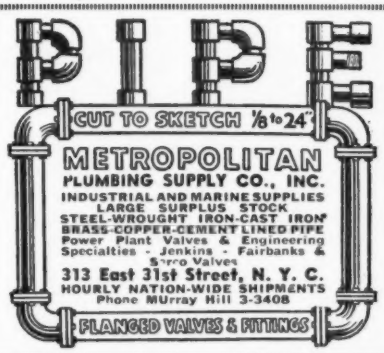
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1000 kw. non-condensing turbo generator 240 3 phase 60 cycle 200 lb. gauge 50° super heat 5 lb. back pressure

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Tanks, boiler accessory, etc.

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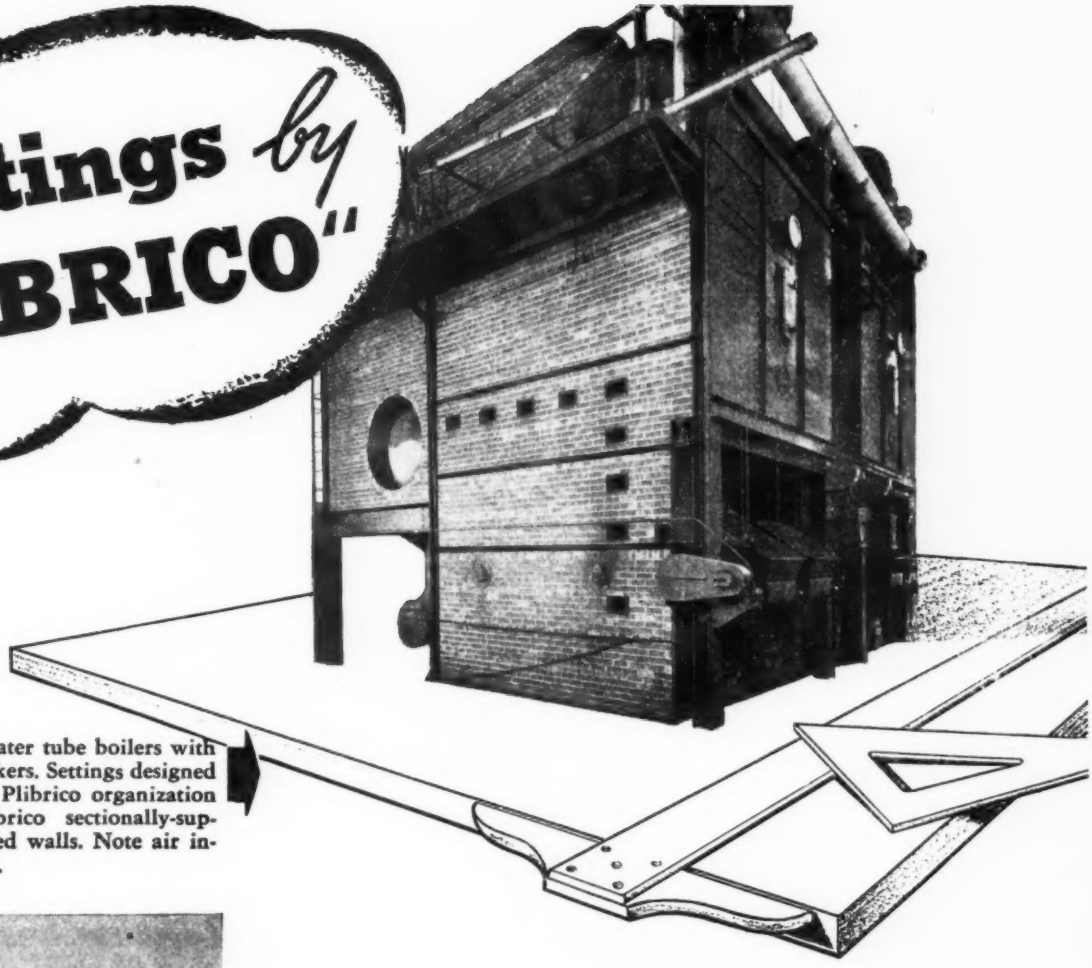
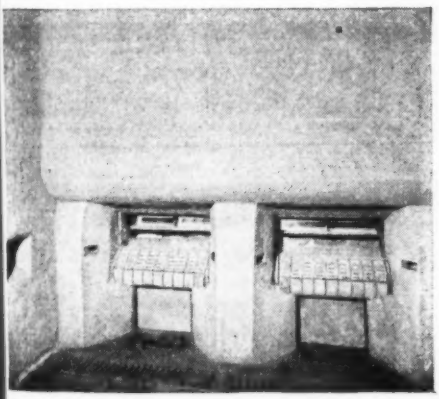
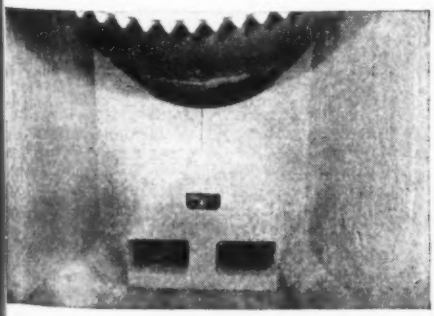


Two 350 hp. water tube boilers with Detroit Rotostokers. Settings designed and erected by Plibrico organization employing Plibrico sectionally-supported, air-cooled walls. Note air inlets in side wall.



Plibrico lining in connection with Detroit Rotostoker showing ignition arch and door jambs. Note how this Plibrico installation replaces innumerable special shapes—an ideal application for Plibrico.



Plibrico lining in connection with H.R.T. boiler fired by Iron Fireman pneumatic spreader stoker. A sectionalized monolithic lining which is durable and economical.

WHEN you find an outstanding boiler setting job, you are likely to find "Settings by Plibrico"—engineered and erected by the Plibrico organization and employing Plibrico full-monolithic construction throughout.

The Plibrico organization offers expert installation and boiler setting service throughout the United States and Canada. We specialize in the construction of Plibrico settings, monolithic linings, air-cooled walls, suspended arches, and Beco-Turner baffles. We have had broad experience in the modernization of existing boiler settings, through more advanced furnace and baffle design.

Monolithic Plibrico linings are more durable and economical. There are no weak joints to open up—no individual brick to loosen and pull out. Bulging is positively prevented by ingenious Flexo-Anchors. Where desirable, Plibrico linings are readily sectionalized by means of our Taperlok supports.

Plibrico construction is as suitable for a small repair job as for complete boiler settings. Your local Plibrico distributor will gladly quote on your requirements. Or write for the big Plibrico catalog. (Specify water tube or H.R.T. boilers to receive proper literature.)

PLIBRICO JOINTLESS FIREBRICK COMPANY

1818 N. Kingsbury St., Chicago 14, Illinois

PLIBRICO *Boiler* SETTINGS

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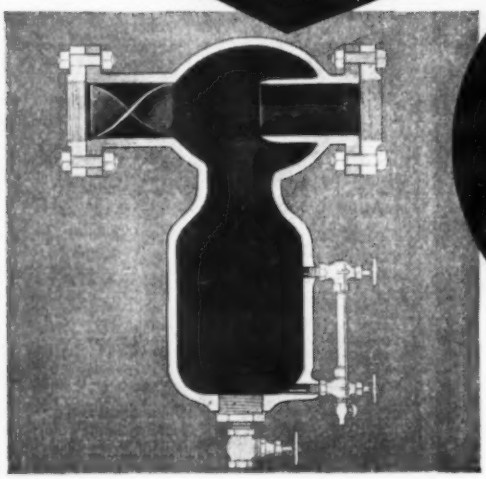
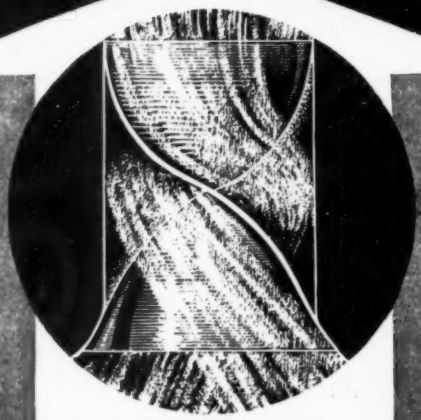
The Whirl Does the Trick

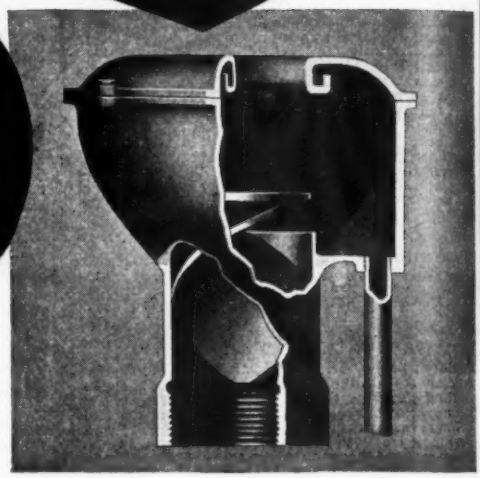
of purifying your steam & oil through **Swartwout Separators**

of drying exhaust steam through **Swartwout Exhaust Heads**





The helix in Swartwout Separators and Exhaust Heads gives the entering steam a *positive whirling motion* that throws aside all impurities.



NO SLUGS OF WATER CAN SLIP THROUGH Swartwout Separators to ruin your engine or turbine; no dirty oil or grease to spoil work in process or gum up pipes and machinery. This high degree of separation is gained with practically no pressure drop. Nothing impedes the progress of the vapor being purified. Swartwout Separators are made in vertical and horizontal styles, and in a dozen sizes. Also highly efficient Air Purifiers.

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SWARTWOUT CAST IRON EXHAUST HEADS were the first to replace the unsubstantial sheet metal heads that were quickly destroyed by corrosion. The same helico-centrifugal principle as used in Swartwout Separators works as efficiently in the Exhaust Heads to remove oil and water from exhaust steam, thus preventing the damage these substances cause to roofs and side walls of your buildings. Made in a wide range of sizes.

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18501 Euclid Avenue • Cleveland, Ohio

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Swartwout Exhaust Head in use at Dominion Coal Company, Glace Bay, Nova Scotia,

Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

Swartwout

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ALL THE TIME
Grinnell CONSTANT-SUPPORT Hangers
The ONLY Constant-Support Hangers!
Constant support of piping in all "Hot" and "Cold" positions
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Non-resonant, energy absorbing
Mass produced from standard precision parts
Individually calibrated for each specific installation
Load-adjustment features are incorporated into the design
3 models meet entire range of load-travel specifications
Minimum headroom required
Write for data book containing complete details.

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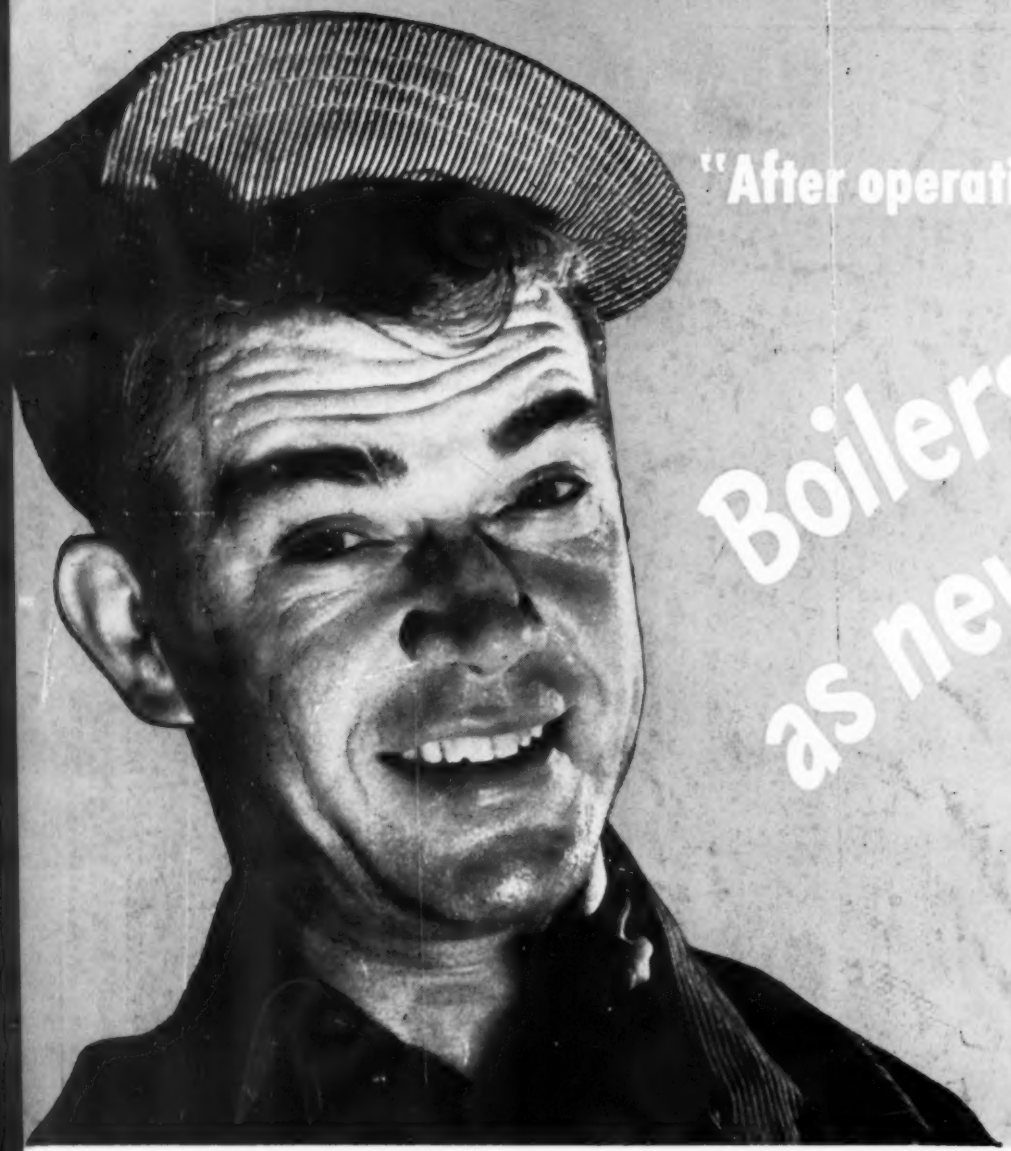
WHENEVER **PIPING** IS INVOLVED



"After operating a full seas n.

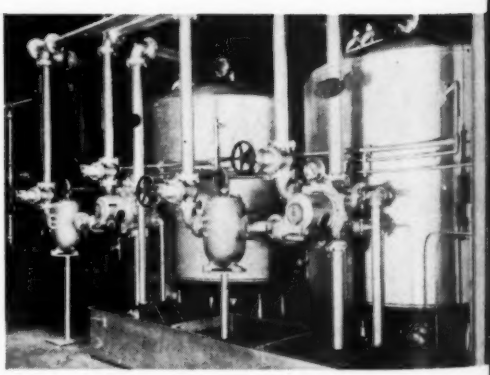
Boilers clea as new metal

"No scale, no corrosion"...when Permutit controls water quality

You can speed production at your plant simply by controlling the quality of the water you use. It's the impurities in feedwater that cause scaling and corrosion of boilers and steamlines.

Permutit* removes these impurities *before the water enters boilers,* preventing shutdowns and destruction of equipment. World's largest manufacturers of water conditioning equipment, Permutit provides *every* process for controlling water quality.

Take no chances . . . keep *your* boilers "clean as new metal" with Permutit equipment. Write about any water problem that you may have to The Permutit Company, Dept. A, 330 West 42nd Street, New York 18, N. Y.



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Serving industry and the armed forces . . . with GOOD WATER!